The Australian & New Zealand

JOURNAL OF SURGERY

VOLUME XIX — 1949-1950

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SECRETARY,
Royal Australasian College of Surgeons,
Spring Street, Melbourne.

Business Managers:
A. H. MASSINA & CO. PTY. LTD.
350 Swanston Street, Melbourne.

ANNUAL SUBSCRIPTION, £2 2s. 0d.

SINGLE NUMBERS, 10s. 6d.

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1

William Allan Hailes

1891-1949.

WILLIAM ALLAN HAILES was born on 9th June, 1891, at Moonee Ponds, a northern suburb of Melbourne, and there he grew up, but spent nearly a year on a station at Gerogery in New South Wales. Later, in long school vacations, he would be placed in the care of the guard, and sitting high up in the van, would return to this station. Here Hailes developed his fondness for the countryside, and he never lost his keen interest in the land and its activities.

From the Essendon Grammar School Hailes passed on to Scotch College, then at the old bluestone building in East Melbourne. Scotch College at that time, even with the disability of distant playing fields, was a leader in Victorian Public School sport. Hailes became a member of the First Eleven and of the Second Eighteen, and passed to the University with honours in physics and chemistry at the entrance examination.

At the Melbourne University Hailes played with the First Eleven and gained his Blue for cricket. He was always among the leaders of his year and in the final examinations gained First Class Honours in medicine, surgery and gynaecology and obstetrics, sharing the Medical Exhibition and the Clinical Medicine Prize with Ralph McMeekin.

On graduating in 1913 he was appointed Resident Medical Officer at the Melbourne Hospital, and the following year became a Registrar. To hold a position on a civilian hospital staff during a war was disturbing to a man of Hailes' character, and the day his hospital commitment was fulfilled he enlisted in the A.I.F. as Regimental Medical Officer to an Artillery Brigade.

The age of the horse has gone from the army, and those who are transported to war in a modern liner have no conception of what it meant in 1915 to plod along for weeks and weeks in a small transport with hundreds of horses packed in stalls on the decks and between the decks. Hailes knew, and when his transport ran into a heavy storm, most of the men and many of the horses were sea-sick. Hailes took his turn with the few men remaining on their feet in managing the horses, and the experience of a medical officer pulling his weight with his men among those beasts founded the tremendous regard in which he was held by the whole brigade.

Later, in France, Hailes was transferred to an infantry battalion and finally to a surgical team. An award of the D.S.O. was the outward symbol of his service, but such awards seldom tell the whole story and the true worth of Hailes' service is enshrined in the hearts of all those associated with him.

The following is an appreciation by Lieutenant-General F. H. Berryman, C.B., C.B.E., D.S.O., G.O.C. Eastern Command:

"I have a clear picture of my first meeting with Bill Hailes; his characteristic shake of the head, his quiet sense of humour, his sympathetic and penetrating questions in search of military knowledge. It was in Albert Park Camp, 1915, when, R.M.O. to 4th Field Artillery Brigade, Bill constituted himself an unobtrusive friend and philosopher to five young Duntrooners, two of whom were killed in World War I, Major-General Vasey in World War II, whilst Major-General Milford and I survived.

"In 1916 we became even more closely associated, and as adjutant to the brigade

WILLIAM ALLAN HAILES, 1891-1949.

I had reason to be thankful for his thoroughness when many gaps in the war diary were made good from entries in his personal diary. In Sausage Gully during the Pozieres fighting and in the winter on the Somme near Flers the stamina of the men was put to severe test, but no concentrated shelling on a battery position ever stopped our R.M.O. from attending the wounded. There was no braver or more devoted man in the brigade. The hardships of that first winter on the Somme kept him busy helping others not only with his medical skill, but by his example, sympathy and selflessness he encouraged others to stick it out when they could easily have gone sick. After Flers he left us to become R.M.O. to an infantry battalion, where he was awarded the D.S.O., a decoration he had earned several times.

"We did not meet again until 20th September, 1918, the day after the successful attack of our 1st and 4th Divisions on the Hindenburg Outpost line, when I was being passed through a C.C.S. near Peronne, where he was a member of the surgical team and attended to my needs.

"After twenty-two years we next met in the Second A.I.F. in the Middle East, but it seemed to us but a little time since we had been together in the 1st A.I.F. Bill was a keen observer and student of human nature and was deeply interested in following the careers of officers he knew in World War I and in examining the qualities that led to their success. Many have lost a sterling friend and will be sad at his passing, but we are all enriched by the memory of a truly great, simple and lovable character."

Hailes often said that his experience as a Regimental Medical Officer was the most valuable of his life.

Before he came back to Australia, at the end of the war, Hailes gained the Fellowship of the Royal College of Surgeons, England, at that time a qualification not held by all Melbourne Hospital Surgeons.

On returning to Melbourne Hailes commenced general practise in Moonee Ponds and again turned to cricket as a recreation. He was elected Captain of the Essendon First Eleven, and in order to give of his best to cricket he gave up smoking. But surgery was calling, and when he was appointed Honorary Surgeon to Out-patients at the Royal Melbourne Hospital, he reluctantly abandoned his batting gloves in order to give of his best to surgery. He retired from his practise in Moonee Ponds and moved into Collins Street. His first years were lean ones, but in difficulty and effort lay Hailes' strength, and by sheer merit and hard work he made the grade in consultant surgery that leads to the splendid ranks of our senior surgeons.

Hailes became Dean of the Clinical School at the Royal Melbourne Hospital and a member of the Faculty of Medicine. He possessed all the attributes of a good teacher: sound knowledge, basic simplicity, humour and an understanding of his students.

For five years he served on the council of the Victorian Branch of the British Medical Association, where, because of his wisdom, his wide vision, his great sense of service and of justice, Hailes always contributed something of value to a discussion.

At the outbreak of World War II Hailes immediately applied for enlistment, but the shadow that ten years later was to end his life was visible on the horizon, and he was rejected. With the full knowledge that active service would certainly shorten his life, he somehow managed to enlist a few months later and went overseas with the A.I.F. to the Middle East as Consultant Surgeon with the rank of Colonel. Sparing himself in no way, he filled to the full the opportunities and activities of this position. Later, in the South West Pacific area, he became Director of Surgery to the Australian Army with the rank of Brigadier. From his earlier experience in the first World War, Hailes was able fully to appreciate the surgical problems in the field, and he was able to understand and help in the medical problems of all ranks, from those of the private to those of the major-general.

The splendid surgical record of the Royal Australian Army Medical Corps in World War II was largely the result of Hailes' direction. His technical instructions were invariably models of the clear exposition of sound surgical principles, together with recent developments and their application to conditions in the army. He made it his

business to know personally all his medical officers. He arranged suitable postings for those younger men who wished to develop their surgery and he personally and shrewdly assessed their capabilities. Those worthy of the position were placed in the Surgical Divisions of the General Hospitals or in the Surgical Teams. The development of Surgical Teams in the battle areas was largely due to his initiative and their value was keenly appreciated by the Divisional Commanders in the field. Hailes knew the work of every member of his large team, he advised them, he guided them. Many young surgeons throughout Australia owe their first step on the ladder to his keenness and support for the right young man.

Hailes' great service was recognised by His Majesty The King in the worthy award of the C.B.E. The sincere citation that accompanied this award is endorsed by all who were privileged to serve with him.

Hailes had been elected a Fellow of the Royal Australasian College of Surgeons in 1928. In 1943, during his war service, this College conferred upon him what is probably its most responsible office, Censor in Chief. Because of his splendid record, his sound judgment, his great ability and his humanity, Hailes was eminently fitted to follow the fine tradition of Sir Alan Newton in maintaining the high standard of the Fellows. A year later Hailes was elected a member of the College Council.

After the war Hailes gave much of his time to the rehabilitation training of ex-service medical officers and to general practitioners in the country. To travel with him on one of these Post-Graduate week-ends was an unforgettable experience. His keen knowledge of so many and so much, his stimulating, concise pronouncements, his critical assessment of individuals, were a joy to his companions. To sit beside him at a cricket or a football match — and he never missed an important one — was to listen to a series of rapid, staccato, keen judgments on players, umpires and performances.

With his generous, fair-minded make-up, Hailes was always open to conviction, but his opinions required a deal of shaking. He loved an argument. Not always did everyone or even anyone agree with him, but everyone knew that consideration of himself never entered into any of his decisions. There was no grain of pettiness or meanness in his ruggedly, honest personality. His fine sensitiveness was generally masked by an abrupt manner often mistaken for a brusqueness. The fine gold of his make-up did not glitter.

Hailes was a reader — history, geography, biography — and his passion in life was for people, their personalities and their achievements. Golf to him was a task to be mastered and he mastered it fairly well. Fishing far away on some stream with one or two good companions was perhaps a relaxation, and his hands were seen at their best in quietly, patiently tying his flies.

Bill Hailes was a character, a great, kindly, courageous character.

His end came swiftly, as he would have wished it. Surrounded by many of his service comrades, on the occasion of a dinner to his life-long friend Neil Fairley, he collapsed and died the following morning (22nd January, 1949). His influence, his personality remain, old soldiers never die. We salute a great man, a great soldier and a good companion.

The portrait accompanying this appreciation was done by the late Julian Smith.

THE GEORGE ADLINGTON SYME ORATION.

THE AGE OF REASON.

By JOSEPH BURKE, Melbourne,
Professor of Fine Arts, University of Melbourne.

WHEN I first received the invitation to deliver the Syme Oration, I wondered with what expectations an art historian had been invited to address a College of Surgeons. Naturally my thoughts turned to the relationship between art and surgery, and I remembered that Mr. George Bernard Shaw had once written a play in which an artist, a doctor and a surgeon were among the chief characters. The play proved a disappointment for my purpose, for so far from emphasising the similarity, Mr. Shaw drew a marked distinction between artists on the one hand and surgeons and physicians on the other. The latter, he recommended, should be immediately enrolled as members of the Civil Service; whereas artists were to be exempted from all governmental regulations, and a good many moral conventions as well. I felt that if I accepted and developed this argument, some of my audience might come to regret they had not chosen art instead of surgery as their profession.

Having failed in my recourse to the *Doctor's Dilemma*, I next pondered the part played by surgeons, and in fairness physicians also, in the promotion of the fine arts. Ever since the Renaissance, with its focussing of interest on man, and man's body as a symbol of ideas, the artist and the surgeon have found a strong bond of common interest. Donatello, Michelangelo and Rembrandt dissected the human body; among British artists, William Hogarth cultivated the society of the leading surgeons of his age. Some of the great historic collections have been formed by surgeons and doctors. This tradition of interest in the humanities is by no means dead, and I count myself fortunate in the friendships with surgeons which my profession has fostered. But here, alas! a note of warning has to be sounded. There is hardly a surgeon of world eminence who is not distinguished by a love of art or music or literature. There is hardly a student of surgery or medicine daring to sustain an interest in art or music or literature, who does not fail his annual examination. Here, indeed, was a tempting theme, for the division between science and the humanities is one of the most regrettable features of modern academic life. However, that this College should have invited, not a surgeon, nor even a scientist, but a Professor of Fine Arts to address it, seemed conclusive proof that I should be preaching to the converted.

Finally my thoughts turned to a very distinguished Englishman whose personality has had a decisive influence on many of our best living painters. Henry Tonks was both a surgeon and an artist. He was a surgeon, already appointed to one of the London Hospitals, when he gave up a promising career in this profession. He became instead a good and at times an excellent painter. But above all he became a great teacher. It is safe to say that no future history of English painting can omit reference to Tonks' influence first at the Westminster School and then at the Slade. In 1927 Tonks turned up, rather unexpectedly, at Victoria Station to say farewell to an Australian visitor*. "I have been much interested," he said, "in what you have told me about your young country. I shall never be able to visit it, but I should like to send through you a message. It is a message based on a lifetime of teaching young people. Beware of mediocrity."

In these three words Tonks summed up the essence of his two vocations. Surgery, which is so often a matter of life and death, cannot afford the price of mediocrity. And what is art but an attack on mediocrity of living? The aim of the artist is this: so to paint, to carve and to build that the men and women who behold shall go their way with a heightened consciousness of life and its value.

But Tonks did more than sum up what he had learned from two professional educations. He diagnosed one of the principal complaints

* Mr. Russell Grimwade.

of modern civilisation. I think it was Max Beerbohm who said that he was tired of the expression, "the age of the common man." What he wanted to hear about was the age of the uncommon man. The aim of civilisation is surely not to produce a uniform and dull level of organised mediocrity. Still less is it to produce a society, such as we see in certain parts of the world, where the voice of the uncommon man is effectively silenced. Never before in the history of mankind have the different groups and interests and classes of society been so welded together and so disciplined in mass formations. This is an inevitable and just process, and it would be disastrous folly to attempt to put the clock back. But there is a danger in this tendency, a danger that the members of the formations will compensate for their individual mediocrity by their collective strength. Any philosophy, any scientific or speculative enquiry, any art which rises above the common level and challenges or differs from the opinions of the majority, will then be condemned. A standardised social community, in which every member acts and thinks alike, is the goal, not of democracy, but of dictatorship.

We must be on guard, therefore, against the dangerous cult of mediocrity which is steadily spreading throughout the world. One of the symptoms of this growth is the hostility that is increasingly shown to personal distinction in manner, in speech, in dress and, not least, in intellect. No great nation seems to be exempt. In the United States and Great Britain second-rate film actors, writers and even crooners are mobbed as if they were national heroes; whilst in Soviet Russia painters who perpetuate the worst academic traditions of the nineteenth century are hailed as masters of the modern movement. I have already referred to the tendency for members of mass formations to impose their collective opinions and values on other members of the community. Scarcely less deplorable is the way in which the taste of the people is regulated and controlled by commercially standardised changes of fashion. It is a question, not of choice among many new looks, but of the one and only new look, which the public is allowed to take but not, alas! to leave. In the midst of this standardisation of dress, of taste, of habit and idea, the uncommon artist or writer or scientist — and not even science is exempt — is increasingly isolated and in some countries actually proscribed. And yet it is precisely on such uncommon men and women that the future progress of humanity depends. I need hardly remind you that the history of surgery is particularly rich in examples of great men whose discoveries have been thwarted and denounced by the rigid and standardised opinion of their contemporaries.

It is surely a matter of some concern that the broad tendencies of society to-day are more favourable to the virtues of shared mediocrity than those of unshared excellence. Connected with this cult of standardisation is an attitude of indifference and even hostility towards the past. Respect for the past has ceased to be, for many sections of the community, an important factor in regulating and guiding political decisions; for these sections the past is merely something to be swept away as quickly and thoroughly as possible. In the sphere of manners, both public and private, the consequences of this hostility are no less deplorable. Already the writers of popular fiction, so often the mirror of popular thinking, use the expression "old-world courtesy." How much better it will be when they can refer, with equal justification, to rudeness as old-world! I look forward to the day when our great-grandchildren will read in their fiction some such sentence as this: "Uncle James behaved with typical old-world rudeness, a relic of his twentieth-century upbringing." Last but not least, in the realm of culture, hostility to the past is manifested by the wholesale destruction of historic monuments and buildings. During the period of rebuilding that followed World War I, a member of the Georgian Society remarked that the highest praise to be given any beautiful house in London was to say: "it is almost good enough to deserve demolition." The remark is equally applicable to the lovely early Colonial architecture of Sydney. This architecture should be as inviolable as the parks. Like the parks, it serves no industrial or commercial purpose. Like the parks, it is a reminder of values other than those of industry and commerce. But in an age without respect for the past, and with little heed for beauty, these gracious memorials of Australia's past seem doomed to disappear.

This careless and ungrateful destruction is more than a symptom; it is a symbol. An age of mediocrity not only dislikes the past: it fears it. One of the first actions of any modern dictatorship is to re-write the text-books of history, so that unfavourable comparisons can no longer be drawn. Emphases are taken off certain periods and concentrated on others which seem to provide a sanction for the methods and aims of the dictator. The motive of the historian is no longer to discover truth, but to find arguments for party propaganda. It has been said, and with some truth, that there is no such thing as the disinterested historian. But there are historians who are interested in the truth, and whose minds are open to change. Such historians are quickly detected and eliminated in the modern authoritarian States. There could be devised no more effective means of countering the influence of the past than by restricting its interpretation to a school of history controlled by a single political party.

Fortunately, ours is still a free society, and it is possible to draw attention to the dangers both of historical neglect and of false history. It is also possible to clear the open historical approach, with its respect for the past, from accusations of conservatism and reaction. For the first lesson of history is that societies must change if they are to survive. A rigid conservatism may postpone, but it cannot avert destruction. And history also teaches us that those societies which have turned to the past for inspiration have also best adapted themselves to changing circumstances. No period of history has undergone more rapid and revolutionary changes than the Renaissance, and yet the Renaissance is distinguished above all by the revival of antiquity. It was the age, not of mediocrity, but of excellence, for men measured themselves, constantly and consistently, by comparison with the achievements of the past.

If we ourselves make this comparison, alas! so unfashionable to-day, the results are neither flattering nor comfortable. In the sphere of the fine arts, perhaps the truest index of a nation's spiritual health, we witness an era of popular decline, and even degeneracy. It is true there are promising and distinguished schools of contemporary art, first and foremost in Mexico, but notably also in England and Australia, and I have Sir Kenneth Clark's authority for placing Australia third or fourth in a world list. But these contemporary schools are supported by a very limited public. In Australia the art of the aborigine, before it was affected by contact with the white man, is vastly superior to the popular art being marketed by commerce. Even if we take into account the best that has been produced, our civilisation has erected few, if any, buildings that can stand comparison with the temples of ancient Greece and the cathedrals of mediaeval France. Nor is it simply a question of buildings. Our age can point to many great scientists, but where are the adventurers, the humanists and the poets to compare with those of past generations?

Not all the comparison, however, is unfavourable, and we have every right to be proud of an outstanding achievement in science. Moreover, applied science offers a new hope for the future, a hope that spacious living, hitherto the prerogative of a few, may be extended to every member of the community. The civilisations of the past have been based, and have inevitably been based, on the culture of a minority. If the modern technological discoveries are used in the service of society, and not in its destruction, every citizen of the world should be able to enjoy a substantial degree of freedom from the mere struggle for existence. The democratic ideals of Athens, but without Athenian slavery, should then be capable of fulfilment.

I have referred to change as the law of survival for all societies. Science, and particularly the biological sciences, are as clear on this point as the evidence of history. But if we are to preserve the best of the old in the new, we must aim at change rooted in the past. Unlike the modern authoritarian States, we must be prepared to look back on the whole of the past, and reject or discard nothing of value. And here I think a special responsibility rests with the British Commonwealth. More than any other nation or association of nations in the world to-day, the Commonwealth is the trustee of the past. Soviet Russia has turned its back, for good or ill, on the two main traditions of European culture: the classical, with its concept of democracy, and the Christian, with its moral and ethical standards. The United States of America is fortunately more liberal, but

already authoritarian elements are beginning to appear, and these would receive a tremendous impetus if the light of the Commonwealth were eclipsed. In Great Britain, on the other hand, there is a tradition of change which has always kept its link with the past. The England of Queen Victoria was different from that of Queen Anne, just as the England of Queen Anne was different from that of Queen Elizabeth. And yet something has remained constant. Running through the changes of the centuries is an unbroken thread of historical continuity, of peaceful evolution and respect for the past.

Foreigners are sometimes puzzled by the fact that nothing in England ever goes completely out of fashion. Gentlemen still wear wigs and knee breeches and lace and carry small swords. I am not referring to theatrical performances and fancy dress parties, nor even to the conduct of eccentrics, and I am glad to say the standard of eccentricity is higher in England than in any other country in the world. I am referring to the costume of perfectly normal and eminently respectable citizens like judges, town clerks and officials of both Houses of Parliament.

These survivals of fashion, which seem to the foreigner so quaint and amusing, are not mere curiosities, they are evidences of the Briton's profound respect for the past, a respect which governs those far-reaching political and social changes which the Commonwealth alone has been able to effect by peaceful means. They are also evidences of a determination not to reject anything worthwhile, and to allow old ideas as well as new ones to stand the test of experience. That is why allegiance to the Crown has so strong a hold on the British imagination, and is so important a symbol, not of conservatism, but of stable progress in an age of violence and insecurity.

The present should look back on the whole of the past, and reject nothing of value. For what is the past but a great treasure-house of ideas and values, which only a free society can enjoy? And here perhaps a student of the Eighteenth Century may be forgiven if he draws attention to certain peculiar merits of that century. I should like to argue, if there were time, that it produced the last civilised society the modern world has known. You might not all be convinced, but everyone, I think, will agree that the century had a rational approach to life, an approach which is summed up in its splendid title, the "Age of Reason." The basis of this rational attitude was not only good logic, which is rare, but good manners, which are rarer still. It was an age of tolerance. Its governing principle may be summed up in the sentence: "Let us tolerate all but the intolerant." I hesitate to say what the consequences would be if this principle were applied to our own society. The rational spirit condemned Enthusiasm, a word which meant in the eighteenth century not zeal, but fanaticism:

> *No wild enthusiast ever yet could rest*
> *Till half the world were, like himself,*
> *possess'd.**

This spirit of tolerance made it possible for an atheist, the historian Gibbon, and a Christian Bishop, Watson, to exchange sincere compliments in the midst of the most heated controversy of the age. It also made it possible for the far-reaching reforms of the nineteenth century to be initiated, if not without bitterness, at least in accordance with the peaceful machinery of a democratic constitution.

In other words, the "Age of Reason" is a reminder of those values of reasonable conduct, tolerance, free enquiry and humane sentiment which the world needs so badly to-day. It is also a reminder of a liberal attitude to history. The eighteenth century was steeped in the classical tradition, but it did not limit itself narrowly to the culture of Greece and Rome. On the contrary, it was interested in the history and customs of China, the South Sea Islands, the Middle Ages and Scandinavia. One of the pleasures of specialising in the eighteenth century is, in fact, the wide range of other periods and cultures which it embraces. And surely the aim of a liberal education is precisely this, that the mind should be able to move freely in all periods of the past, and be open to the best that each has to offer.

But here there must be one reservation in our praise. The great qualities of the eighteenth century, its merits and its benefits, were confined to a very small class. Very

* William Cowper — *The Progress of Error.*

few members of this class seem to have worried because this was the case. This was a grave fault, and I think we can claim an improvement in our own times. To-day there are fewer people who enjoy some peculiar privilege or benefit and do not look forward to the day when the same kind of privilege or benefit can be enjoyed by every member of the community. Most of us, I suppose, have some idealistic friend who talks of the classless society. There is a sense in which the ideal of a classless society was realised even within the limitations of the eighteenth century. Let me venture upon a somewhat heretical definition. A classless society is one in which the members address one another, not as "comrade", but as "sir". It is a society based not on universal familiarity, which is a low ideal, but universal respect, which is a high one. Such was the society of the famous Literary Club, of which Drs. Johnson, Reynolds, Goldsmith, Burke and others were members. If we are to set before ourselves an ideal community, as we should, let it be one in which all members, however moderate their gifts or humble their occupation, show respect to others and deserve it themselves.

And here perhaps some of you may suspect that enthusiasm for my chosen period, the eighteenth century, has influenced my choice and treatment of theme this evening. I can only plead that the theme itself was partly suggested by a memorable afternoon in which Sir Alan Newton showed me over the great historical library of the College of Surgeons at Melbourne. This library is particularly rich, as you are no doubt aware, in the medical and scientific literature of the eighteenth century. I did not myself know this when I came to Australia, and the discovery offered some consolation for the fact that the College occupied what would otherwise be an ideal site for a new and better Melbourne Art Gallery. Subsequently I was given permission to read in the library and learn more about the distinguished surgeons of the century and the part they played in its artistic life.

Yours, if I may say so, is an aristocratic profession, and can never be otherwise. It calls for the best in a man's achievement and it depends on an unusual order of ability. Men like the late Sir George Syme must be rare, and yet such men have always placed themselves at the service of the less gifted. Syme also, as this foundation shows, wished to serve the future as well as the present. I believe the profession of surgery will always tend to produce men of this calibre. For in an age so favourable to mediocrity, surgery shares a mission similar to that of art, a mission of preserving the standards that are threatened by mass tendencies. It is also committed to a defence of tolerance and free enquiry. These are the values of the eighteenth century, of which I was reminded, in their relation to your profession, as I looked, on a summer's afternoon, at the old gilt and calf-bound volumes in your library. If these values can be preserved, and if man can master his machines, may we not look forward to a new and wider Age of Reason, in which the common man will recognise and respect, both in himself and in his neighbour, something which is uncommon?

THE HAMILTON RUSSELL MEMORIAL LECTURE.

THE SURGERY OF HERNIA — HAMILTON RUSSELL'S CONTRIBUTION.

By JULIAN TAYLOR.

London.

(Accepted for publication, 15/2/49.)

MY first duty is to thank you sincerely for the honour you do me to-day in asking me to address you on so important an occasion as the Hamilton Russell Memorial Lecture. I remember, from my school days, a famous line from Cicero, who, in addressing the patres conscriptes of the Senate, found himself "magis oneratus quam honoratus" — his task seemed to him even more onerous than it was honourable. For me the honour and the burden are exactly equivalent, and I am more than distrustful of my capacity to earn the one by carrying the other. Last year it fell to my lot to address the Royal Society of Medicine on the subject of a great surgeon whom I knew well and in whose work I had had a very small part. To-day I must address you to honour one whom I never knew but by repute. When our subject himself delivered his Ann Mackenzie Memorial Lecture, he congratulated himself on being released from restriction as to material, and with a charming apology to the memory of a great woman, he left her to her sleep, then spoke of Lord Lister as he knew him. Such licence is for the Russell's only and your Council has asked for a subject from among his many surgical interests, wisely, I think, for it is better for me even to speculate a little on a great but strange figure of surgery than to turn perhaps to another so attractive to speakers the contemplation of the ego. After much thought and hesitation, I have chosen the subject of Hernia. I shall not apologise for speaking of so common a malady, for that would be as absurd as it would be discourteous to the man we honour to-day.

Hamilton Russell was born in 1860 and became a Fellow of our English Royal College in 1889, the year of my birth, but it was not until the turn of the century that he began to write. Here then is the first note that we make about his character — he did not write until he was close on forty and well-established in his art and reputation. How different from the present day. For in our wisdom we have adopted the custom — I might perhaps call it the curse — of our academic and purely scientific brethren, which now ordains that the young new-comer to medicine must establish himself on the basis of what he has already written. In plain language, he must write if he wants a job. This single fact is the causa causans of the chaos of medical literature to-day. For in many Universities the Medical Faculty is as big as all the purely scientific ones put together, and thus in a very few decades publication has reached the enormous and unwieldy proportions that characterise the output of medical literature to-day. I think it may have escaped the attention of the members of the smaller scientific groups that what has been written must of necessity be read. We have not the option of the bookstall where to miss the worthwhile in a mass of futility does not necessarily matter. What has been written must be read, for we cannot afford to be unaware of elements of progress however inconspicuous they may be. Thus, before embarking on the study of a surgical subject, we must grapple with an enormous and discouraging bibliography, and the fact that it may often be provided by the efficient secretarial staff of a learned institution is not the healthiest of reliefs. In England an alleged shortage of paper provided a faintly brighter prospect that has vanished with nearly every other post-war hope. Hamilton Russell had views on this matter and, with accurate vision, saw what was coming with the twentieth century. In 1914 he expressed his distrust of the value of statistics and, further, when speaking of Lister he said that that great man "did not hesitate to draw immense and far-reaching conclusions from the observation of a single case." To Lister the literature and the statistics as we know them were still unwritten; the observation is therefore Russell's made at a time when the stream of literature was just rising, but was not yet in spate. Lister's and Russell's

attitude was exactly that adopted by another great surgeon of our time. When Wilfred Trotter began to study the growths of the mouth and pharynx, he observed with accuracy the patients that came his way. In a surprisingly few years, using neither percentages nor logarithms, he had noted that these cancers fell into certain clearly defined groups. For each he described the characteristic grades of malignancy and lymphatic extension. More remarkable still, he gave their extraordinary sex distribution. No statement that he made has been challenged since, though his conclusions were based on a very few patients encountered during a very few years. This is also the approach of Hamilton Russell to clinical problems, and it is for this reason that I have delayed a little to refer to the work of another with a kindred spirit. Russell believed that accurate observation carefully considered is a straighter way of progress than is the collection of figures, especially of other peoples, the so-called statistical method so popular at the present day. Here then we may observe a second character in the famous man we are praising. He did not write prematurely, but he did not wait until large numbers of records had been accumulated. Nevertheless, he obviously liked a theory for its own sake, and among his favourites was what he called the Saccular Theory of Hernia. Trotter also liked a theory, though few could discover this from his writings, but I must not be tempted to the fascinating comparison of two great men's minds, for I should delay too long my subject of hernia.

Short Historical Review.

The treatment of inguinal hernia affords a typical surgical study, for it discloses a number of advances with long, sluggish intermissions. As so often happens in medical and surgical progress, we have on at least two occasions advanced to the point whence we started, here the need to avoid weakening of the inguinal musculature by operative trauma. Surgical advance is often like great circle sailing, one continually alters course, but in the end one arrives, apparently infallibly, at the point whence one started. Thus the great anatomists, notably Astley Cooper, described the structure of the inguinal canal which Lister left intact when operating for strangulated hernia. Bassini, a little later, introduced his well-known plastic procedure. Then, a little later, came Halsted with another, modified by yet other surgeons. But in about 1900 Hamilton Russell pointed out the importance of preserving muscular power and function. So the first great circle was complete in about twenty years. Russell, however, at this point discloses in his writings a not unattractive human character that is shown by many enthusiasts, an impetuous tendency to overemphasis. For instead of asserting that an important function of the abdominal musculature is the prevention of hernia, he asserts that the abdominal wall is impenetrable in the absence of a hernial sac — that is to say, he gives it the divine attribute of infallibility. Thus many people, perhaps the majority, discount his work on hernia because his medium of expression misleads them. Russell, later, saw this himself and made a handsome apology for an over-statement.

For the next fifteen years, surgeons were divided in their opinions. The majority were in favour of one or other of the plastic procedures, but there was an increasing number of those who, shocked at the existence of recurrence, agreed with Hamilton Russell that sacs should be removed and muscles respected in inguinal hernia. It was, however, beginning to be realised that an unpleasantly large number of operations for the relief of inguinal hernia were inadequate. Then came the first World War and experience served rather to stress the widespread persistence of disquieting failure than to give assurance of progress. For in all services the frequency of recurrence after operations for hernia in young, healthy, athletic subjects caused an enormous unnecessary invalidism, the impotent concern of administrative authority. It is probably true to say that in spite of the vast size of our Armies of 1914-18, far exceeding the figure of 1939-45, the only progress that we made in hernia management during the first World War that surgeons everywhere became conscious of failure, the first step towards improvement. For the general sense of incompetence, of not quite knowing what they were at, had one good result, that inguinal hernia became less and less the living material for the training of apprentices, more and more the interest of trained surgeons. There is now reason to believe

that although the multiplicity of procedures still in use makes it certain that finality is still far away, we are making some progress, that the second World War has not left us just where we started in the management of this disability. It is of modern ideas and tendencies that I wish to speak to-day, and I think you will agree with me that some of these, at any rate, are the development of Hamilton Russell's conceptions.

Recurrence of Inguinal Hernia.

It is hard to imagine a malady in which the success of operative treatment should be more clearly assessed than inguinal hernia, for the variables are few, the failures many. Yet discussion has continued for fifty years, and surgeons still regard its radical cure with the cautious reserve that an optimistic adjective engenders when qualifying a surgical procedure.

The frequency of recurrence has been statistically assessed by many surgeons, notably by Sir Max Page in the early between-war years, who found in one group of healthy policemen a recurrence rate of 20%. It is certain that the recurrence rate in the United Kingdom at the beginning of the late war was not less than 12%. Yet the statistical study of recurrence has failed to throw any light on its cause and surgeons have turned to the more congenial task of observing in detail the anatomical nature of recurrence as it is presented on the operating table, with the aim of understanding more clearly the original causation.

There are in general two varieties of recurrence in inguinal hernia, the direct and the oblique.

Direct recurrence.

The less frequent but extremely common form of recurrence is the direct, which is seen whether the original hernia were indirect or direct. These direct recurrences following operations for indirect hernia have been thought by many to be the consequence of the performance of Bassini's operation, which, by an allegedly injudicious interference with the posterior wall of the inguinal canal, may be thought on occasion to produce direct hernia. We can have little doubt that this operation, like any other that attempts to replace the transversalic fascia by displacing with tension another structure such as the conjoint tendon, can, in fact, produce direct recurrence. I cannot nevertheless agree that the Bassini operation deserves the canonical condemnation that it has received from some authorities. I should prefer to say that if one considers great benefit to large numbers, Bassini by his operation is probably second only to Lister as a surgical benefactor to mankind. For the worst figures show six or seven in ten cured of what is perhaps the commonest surgical malady. The nature of the direct recurrence is probably obvious. All surgeons are agreed that technical failure to reinforce the transversalis fascia by reason of frail tissues, their rough handling and crushing suture of tension, or simply of suppuration, is clearly a cause of recurrence.

Oblique recurrence.

The appearance of a new oblique sac is the commoner variety. In the past, some surgeons, aware of the occasional occurrence of double sacs, asserted that an oblique recurrence was commonly, in fact, one of such twin sacs that had escaped attention. Others, more practically but even less charitably minded, said that such recurrences were unremoved single sacs. I should like to suggest that these two statements, which were current among the teachers of my youth, were quite untrue and were, in fact, attempts to escape from a problem which they could not answer. I hope shortly to suggest also why the answer was not apparent.

The nature of oblique recurrence is not so clear as is that of the other variety, and needs a little study. To me it is remarkable that a new peritoneal sac can find its way through the fibrotic inguinal canal that is so often seen after surgery, but we must accept the fact that it can because we have seen it so frequently and also because of the remarkable freedom from adhesions to the cord and canal walls that such sacs often exhibit. All sorts of methods of preventing oblique recurrence have been used, including the displacement laterally of the tied-off peritoneal sac, a procedure that may involve damage to the muscular fibres of the internal oblique muscle. But we must give to Bassini the credit of insisting that in his operation the approximation of the conjoint tendon to the inguinal ligament must be continued to a point lateral to the internal abdominal

ring by stitches similarly placed in the internal oblique muscle and inguinal ligament. About the turn of the century, so far as I can discover, while fiercely condemning operative damage to the muscular tissues, Hamilton Russell recommended a cunning stitch in the transversalis fascia, to which reference will be made later. He was trying to accomplish one of Bassini's aims, that of reinforcement in the region of the internal abdominal ring without the damage to muscle fibres caused by the large and comprehensive sutures of Bassini.

Many other surgeons designed plastic operations, but all fell short of Russell's ideals in that they destroyed natural function. So things remained until the close of the between-war period, but we may note at this point that all operations in use, whether they respected muscular function or whether they aimed at the replacement of the natural closure of the canal, probably had more successes than failures.

The Internal Abdominal Ring.

We will leave the subject of recurrence for the moment and will pass to present-day ideas regarding the causation of inguinal hernia. Largely owing to the work of Lytle, attention is now focused on the internal abdominal ring itself, and there is reason to believe that at last we may be on the right track. Why after so many years of modern surgery we should only now be turning our attention seriously to the opening in the transversalis fascia through which the sac passes, is not obvious. It may be that this fascia is strong and resistant only in the young with small hernias, but is fragile and distorted in long-standing ones, in the obese, and where hernias are large. Where the fascia has practically disappeared, its functions in preventing hernia formation must be deduced rather than observed.

The so-called shutter action of the internal oblique muscle in closing the entrance to the inguinal canal does not seem to me to be an entirely satisfactory explanation of the natural prevention of the occurrence of inguinal hernia. Rather it appears to be an example of the common medical practice of attempting to simplify by comparison with homely things. The detailed examination by Lytle of the working parts suggests that the natural closure of the inguinal canal is a nicely-adjusted mechanism of forces and supports, incompetence of any of whose components may cause breakdown, with the occurrence of hernia. But he does emphasise the importance of the internal abdominal ring and suggests the existence of an active muscular movement that closes the entrance to the healthy canal. He has drawn attention to the crescentic fibrous leash to the medial side of the ring and has even described its movement laterally during contraction of the lowest part of the internal oblique and transversus muscles.

Thus, according to views widely held to-day, the penetration of the inguinal canal by an oblique hernia is due either to the existence of a peritoneal sac as stressed by Russell or to incontinence of the internal abdominal ring. The relaxation of the latter may possibly be due to failure of a normal muscular closure, but it is probable that the predominant factor in the production of inguinal hernia is not the same in all cases. There are many similar mechanical problems of support in the body — for example, those of the pelvic floor and of the kidney.

The Inguinal Musculature and Fascia.

The changes that occur in the musculature and fascia of the inguinal canal may be provocative or secondary, may be the cause, or the consequence of hernia, and are always seen when hernias are large. In this connection there is one variety of hernia of which I have had the opportunity of seeing many instances. It is when a large, strong and obese person rapidly loses weight, for example, when a Dutchman lives in a prison camp. An increase in corpulence, unaccompanied by muscular vigour, is understandable as a cause and is a common precursor of many forms of hernia, but just why a decrease in abdominal fat should also be one is not clear to me, unless starvation may have prevented the establishment of muscular strength.

Whatever may be the cause of muscular and fascial weakening, it is easy to recognise. The muscular and fibrous bundles are thinned and weakened and are apt to become separated from one another. Thus, particularly in obese people, the internal and oblique and cremaster muscles bulge, as does the transversalis fascia.

The Operative Methods Reviewed.

Let us now consider some of the solutions that have been offered to the problem presented by inguinal hernia.

1. *When the hernia is small, the subject young, the muscle and fascia strong.*

Excision of the peritoneal sac only.

This was popularised in the first World War in the form of a very simple operation whereby after making a small opening into the canal the cremaster was incised, the sac ligated and divided. The recurrence rate was not reduced thereby, innocent as this operation certainly was of causing significant damage to the canal walls and muscle. A very few recurrences in such subjects as we are describing, following a procedure so fully conservative of natural form and function, should have been enough to make clear that the whole causation had not been completely assessed, and we now believe that in such cases an incontinent internal abdominal ring is the cause of failure. We may therefore think that some form of ring closure may be all that should be necessary in such cases. The method of ring closure to be adopted is not easy to decide. We have already noted that many years ago Hamilton Russell introduced a stitch into the fascia transversalis. It was a diamond-shaped one that should, when tightened, pull laterally the medial edge of the enlarged ring and downwards the upper margin. This was ring closure, though it was not so named, Russell calling it a stitch in the sero-fascial layer, and to-day we are concentrated upon other and more certain technical means of producing the same effect. We should at this point note that Hamilton Russell was many years ahead of his brethren in perceiving the primary anatomical site of the disorder, and in suggesting a method of correction that had not the vice of destroying muscular action, a second great circle has thus now been navigated. The difficulty that presents itself is that of deciding just how to close an opening in a relatively inelastic structure of fine texture such as is the fascia transversalis, for I cannot help thinking that in most cases it has not sufficient strength to react favourably to the insertion of ordinary stitches. Only when the ring is seen, as it may be in young subjects, as an opening in a closely woven but strong aponeurosis is closure of the ring alone likely to succeed. Even in such people it may be hard to believe that the thin, inelastic structure remaining may be relied on to prevent hernia reappearing. Some of us may take heart by remembering from our youth the flight of Peter Pan and the Darling Family or of Madame Trigolati's fairies, according to our tastes on supporting wires so thin as to be invisible. We should then remember that those flights depended on the existence of very fine wire, and in comparison that if we sever any of the fibres of the transversalis fascia by roughness, by using cutting needles or by dissection for exposure, we may divide a filament the integrity of which may be a necessary factor in the mechanism of closure of the entrance to the canal. It is almost certainly because the normal fascia seems to be so frail a structure that the state of the internal abdominal ring has so long been neglected in hernia.

The possibility of doing unavoidable injury to the fascia of the ring immediately raises in the operator's mind the question of reinforcement. An attractive method is the replacement of the incontinent ring by a loop of fascia, cut from elsewhere and fixed at each end in the musculature above and below the ring. The choice of living or dead suture materials will be discussed, but whatever material be used, such a restoration of the ring may be thought to meet the requirements both of Russell and of Lytle—i.e., that the muscular power of the internal oblique must remain undamaged as demanded by Russell, and that the medial edge of the new ring may be expected to move laterally with contraction of the muscles, according to the doctrine of Lytle.

2. *Where the hernia is large, the subject obese, the muscle feeble, the fascia frail, the internal abdominal ring large, or the hernia direct.*

Clearly, in all these cases except the last, efficient closure of the incontinent internal abdominal ring, whether by living or dead material, according to modern conceptions, is a necessary part of the operation.

An essential step in any case would seem to be the development of the patient's musculature by exercise, but I doubt if this can be looked to as a successful preventive of recurrence by itself. Two main groups of methods have been proposed for the necessary reinforcement.

Group 1. Methods by which the transversalis fascia may be reinforced and a strong posterior wall provided for the canal.

In this group are the procedure of Bassini and those that have been evolved from it.

Group 2. Methods by which the normal structure of the canal is destroyed and a new one substituted.

In this group are the methods of Halsted and those that have been developed from it.

Group 1. Bassini inserted large stitches, taking in their embrace masses of tissue, muscular, fibrous and fascial. Though to the best of my belief he did not specifically mention the internal abdominal ring, its closure must have been included by the stitching method he recommended. His aim seems to have been to produce a dense fibrous scar in the region of the canal that should pull the conjoint tendon and the internal oblique and transversus muscles down to the inguinal ligament. Sixty years of surgery have passed and we now know that to place such sutures anywhere in the body is in itself a danger, a technique to be avoided. We must agree, however, that Bassini's operation certainly produces more successes than failures. Where it fails, this may be thought to be due to the occurrence of necrosis within the grips of the large stitches, the muscle and conjoint tendon then wholly or partly tearing away from the inguinal ligament. Such recurrences are apt to be seen as direct ones passing forward through the medial part of the posterior canal wall. In other cases the operator may fail to carry his stitching as far laterally as Bassini prescribed, and in such the recurrence is one of the oblique variety appearing, as did the inguinal hernia, through the unclosed internal abdominal ring. Other ways have been proposed for the necessary reinforcement of the canal wall.

The use of foreign materials.

Forty years ago, McGavin introduced the practice of inserting silver wire filigrees. The idea underlying this was that the wire might be expected to irritate the tissues in which it was placed, to the production of sheets of fibrous tissue, and thus that the eventual disintegration of filigrees which proved to be the rule, would not constitute a serious defect. After a prolonged trial in many hands, the operation was almost universally abandoned. Later, with the search for inert materials, the method or something like it has been reintroduced. Silk, nylon, stainless steel wire, tantalum wire and gauze, have all been employed. It seems that of all these substances, stainless steel is that which is the least irritating to the tissues, is most nearly inert. At this point we must pause to enquire what exactly is the object of using these materials? Is it to stimulate the production of new tissue? Or is it to provide an unabsorbed non-irritant substitute for living tissue? In the former case, we evidently aim at the production of a fibrous sheet, reinforced, but made practically inextensible by a foreign endo-skeleton. In the latter case we propose the insertion in place of the transversalis fascia, between, say, the inguinal ligament and the conjoint tendon, of a new, unchangeable, inextensible, foreign structure that shall, permanently and without reference to the surrounding living structures, take on the function of the natural posterior wall of the canal. Only if some completely inert foreign substance be discovered, having a little of the elasticity of sheet rubber, can a theoretically satisfactory substitute for natural living fascia be said to have been found. In addition, it must be so fixed in its bed that it must, so to say, heal in place. For if, for example, it is to replace a weak conjoint tendon, it must be able to transmit the pull of the internal oblique and transversus muscles. I do not doubt that the employment of these foreign bodies can be justified by successful use, and I believe that in Australia this is being achieved. I have seen large numbers of hernias successfully treated by the introduction of floss silk in the surgically disgusting surroundings of a prison camp. But in these days of tissue grafting I cannot believe that this is the best we can do.

The grafting of living tissue.

I turn therefore to a procedure that I find more attractive: the use of living fascial grafts. We have already noted one form of fascial graft, that used to replace the incontinent ring. The remainder of the inguinal canal may be strengthened by placing in its posterior wall—that is to say, in front of the transversalis fascia and conjoint tendon—a sheet of living fascia, either woven in place as proposed by Gallie, or turned downwards from the rectus sheath, as proposed by Bloodgood. My own preference is for

the former because I dislike being restricted in the amount of tissue available, and I distrust a rectus sheath that I had weakened.

Whichever type of replacement we use, we are reinforcing our stretched fascia by something very similar but stronger, and we are putting no strain whatever on the inguinal musculature or inguinal ligament. There is no reason to suppose that such grafts may fail to heal in their new sites. Were I capable of doing so, I should not delay here to discuss the actual physiological process by which autogenous transplanted tissues retain or regain their vitality. I shall do no more than state the well-known fact that they preserve their anatomical appearances with little change for very long periods, the only external evidence that they are alive being that they have not been absorbed and are capable of bleeding. If they have been inserted with anatomical precision, there is every reason to suppose that they will take on the functions of the natural canal wall whatever they may be. That is to say, even if we do not completely understand the inguinal mechanism, we are replacing by a good substitute the defective natural working part. We may suppose, however, that displaced tissues, like displaced persons, may need a longer time in which to complete the process of fusion with their surroundings than is the case with the undisplaced. I doubt, therefore, if it be wise to put any considerable strain on grafted fascia before the passage of, say, eight weeks.

An ingenious surgeon in England, casting about for a substitute for fascia, has made use of the dermis. Surprisingly, it seems to cause little trouble, either from sepsis or from epithelial implantation. The dermis has the virtue of elasticity, but I would suggest that the thickness of the transversalis fascia being perhaps half a millimetre, there is no need to replace it by a tissue half a centimetre thick.

The use of living bone for the same purpose seems to me to have no virtue other than that it is an autogenous substance, and that perhaps also the body may see fit to remove the lime salts from its substance, unnecessary now that it has been transplanted.

I trust that it is clear that I have been discussing only the principles upon which operations must be based for the cure of inguinal hernia and have suggested only the ways in which the types of operation in use may comply with or fall short of the needs implicit in the structure of the natural canal.

Group 2. The second group of operations typified by that of Halsted comprises a number of procedures in which the ligated necks of hernial sacs are laterally displaced with greater or lesser trauma to the internal oblique muscle tissue, and whereby the external oblique aponeurosis is made to assume the functions of the transversalis fascia. For this reason, I have grouped them as procedures by which the normal anatomy of the canal is destroyed and a new structure substituted. I know that they have been successful in many hands, but I have had no personal experience of them, for I suggest that only those operations for hernia that respect natural structure and function will have permanent place in our surgical repertory.

Compromise.

I make no prescription of surgical procedure, for I am convinced that the body can make good use of all sorts of mechanical devices, however strange and however unsuitable for their purposes a thoughtful consideration may suggest them to be. How else could we recover from our war wounds with little functional trace of their history? All that operative surgery ever does is to make a rough repair which the body subsequently adapts to its purposes by its own exquisite joinery. Thus when a hernia repair seems good to a competent surgeon of experience, it is probable that the body will cure the hernia, whatever the plan and technique that have been used, for he has an almost instinctive knowledge of what the body will at first tolerate and later adapt. There are, however, certain defects that the body finds it hard to make good, such as failure to close the internal abdominal ring, stitching methods that produce necrosis, suppuration, and the like, and these are the well-known causes of failure.

The use of fascial suture.

What I have suggested as the ideal in herniorrhaphy constitutes a long and rather troublesome procedure, for the cutting of lengths of fascia, say from the thigh, and their transference to the groin, is a major operation, maybe a protracted one. There is

a large group of hernias in subjects, say, aged thirty to forty-five, that cause misgiving as to the capacity of the posterior wall of the inguinal canal to preserve its integrity after some form of ring closure alone, and if one were to be rigidly logical, one would say that because of doubt in every such patient, one should perform fascial grafting. A surgeon of experience, however, has practical knowledge of what the body may be expected to do for him, and it is probably in this group of patients that a striking success is attained by the insertion of the foreign bodies that have already received notice. My preference for those people is a procedure of the Bassini type that omits the noxious elements of crushing and of tension. Without these two, the body may be expected to deal with the unnatural fixation of the conjoint tendon to the inguinal ligament that constitutes the Bassini procedure. In 1904, McArthur used for suture material in Bassini's operation a narrow strip of fascia out from the external oblique aponeurosis. The details are unimportant, but fascia has advantages as a suture material. It is unlikely to cut out if inserted without tension; it is not a foreign body, and it heals as kindly as the larger fascial grafts. Its disadvantage is that to pass it through tissues larger holes are necessary than are produced by ordinary needles. The technical difficulty implicit in such large holes can be overcome by the use of appropriate instruments and there remain the advantages that have been described which are both mechanical and biological. There is no doubt that this compromise between extensive fascial grafting, which we may call biological pedantry where it may be unnecessary, and the undoubted dangers of the original Bassini operation, has been used with success by many surgeons, especially by Morrison, of Liverpool. I would, therefore, put in a plea for the use of this compromise on occasion.

Being an ordinary general surgeon, I feel the need to add practical justification to theoretical propositions. In comparison with the formidable numbers recorded by many authors, I have nothing of statistical value. But I take heart from Hamilton Russell, who once quoted 63 operations for hernia with three recurrences. The figure that I give you is even smaller. Using ring closure, though, like Russell, I did not so name it, fascial suture or fascial graft in nearly every case, having for patients the most senior and the least promising of the patients in a large prison camp in the late war, all of them suffering from malnutrition in some degree, some the wasted shadows of portly Dutchmen, many of them surprisingly old, in about forty patients, many with direct, bilateral, and recurrent hernias I did not have a defect of healing or a recurrence in three and a half years.

Rehabilitation.

The universal call for what is called rehabilitation has brought into common practice the use of exercises for the abdominal musculature after operations. I am old-fashioned enough to believe that it is wise to postpone such steps until the healing process may be thought to have reached the stage of consolidation. A graft, for example, has not, so to say, come to life in less than two weeks, and its consolidation as a new and living working part may be thought to take two months. I am, therefore, doubtful of the wisdom of permitting patients to walk about a few days after hernia operations. The preservation or re-establishment of function seems never to have been absent from Russell's thoughts, and it is therefore in keeping with his active mentality that he should have devoted himself to the management of fractures. Like another enlightened surgeon of his time, Lucas Championniere, he believed in the rapid restoration of limb function. I do not know enough of the work of either of them to discuss in what ways their methods differed, but Russell, like Championniere, directed his attention to the reduction of the muscular spasm associated with fractures and to its replacement by the contractions of returning natural function. With Russell in charge of a hernia or of a fractured femur, the management was governed by the same considerations of regard for muscular function, and its rapid re-establishment. Some of his ideas may shock our modern orthopaedists, but they have incorporated in their work a good deal of the preoccupation with function that Russell himself described as just "simplicity and common sense."

I propose to say nothing to an audience such as yourselves regarding Russell as a man, attractive though his personality

clearly was. For a stranger to do otherwise, only fifteen years after his death, would be an intrusion.

I have postponed until my conclusion his debatable attitude towards Femoral Hernia, for this is a ticklish part of my task, but I should do no service to him were I to omit all reference to some unorthodox views that became well known.

I doubt if any of us accept either his saccular theory and congenital origin or the operative approach below the inguinal ligament that he appears to have advocated to the end with characteristic vigour. Who, for example, would agree that with competent surgery the danger of wounding the bladder in Lotheissen's operation is so great as to divert the surgeon to an infra-inguinal approach. It is interesting to read his controversy with Sir Arthur Keith, Russell with the experience of a surgeon, Keith with the knowledge of the embryologist. By each contestant, we find that when the battle takes him into his opponent's territory, somewhat fanciful ideas are expressed and without obvious sense of insecurity. For the surgeon says that sacs are congenital and preformed, probably really because he cannot account for their existence otherwise. The embryologist says they are not because he knows they are not, but he goes on to propose that the varying state of distension of the femoral vein may be responsible for the appearance of femoral hernia. The language of the controversy on both sides is scholarly, delightful and persuasive, but had Sir Arthur been a surgeon, I think he might have felt his stance a little insecure. For he would have known that when, in fact, the thin septum between the femoral vein and the femoral canal becomes so inefficient that it does permit the descent of a hernia into both the canal and the venous compartment of the femoral sheath, a state of things is produced that is fortunately rare, but that is unlike the ordinary femoral hernia in that it is extremely difficult to treat.

In 1920, Hamilton Russell referred to "our human proneness to make the patient fit the theory, instead of the theory fit the patient." His sympathy was with the possibly victimised patient, and for this reason I think he may have failed to see that each practice is as poor an approach to the truth as the other. Theories made to fit patients are usually bad ones, and mostly suffer the same fate. There have been many such in surgery and one has but to remember the, as it now seems, rapidly succeeding conceptions of the nature of peptic ulcer, to know that some at least must have been wrong. Yet during the ascendancy of each, large numbers of patients have been relieved of their symptoms by surgeons subscribing to such beliefs. We cannot escape from the conclusion, on the one hand, that theories are unnecessary in the successful practice of surgery in the best sense of the expression, and on the other, that a wrong theory more often than not leads to satisfactory results in the hands of a good surgeon. I realise that such a statement of the exact truth may be open to the construction that I am expressing an immature distrust of surgical research, but nothing is farther from my thoughts. What I do mean to suggest is that the bridge between academic progress and practical surgery must be crossed with the circumspection of the open mind, the discretion of experience and wisdom. But in the meantime patients have to be helped. Here I am sure that I am voicing Russell's point of view when I say that it is more immediately important to put our patient right than to explain just how we do it.

Russell on one occasion referred to a justly distinguished surgeon who had a quaint, mediaeval notion of strengthening of the inguinal region by means of cicatricial tissue. Strictly speaking, this is what every herniorraphy does, but we may amplify it a little by saying that whatever we do to the body, the result of whatever idea, theory, observation, the end result is not our work, rather it is what the body makes of it. It is therefore the surgeon's task to estimate carefully how the body may be expected to make use of whatever operative repair he may make. It is to this end that I have ventured to place before you this evening a number of elementary considerations regarding the nature of operations for the relief of hernia. I should like to think that Hamilton Russell would have accepted them as simplicity and common sense.

BRONCHIECTASIS IN CHILDREN.

By T. Y. Nelson.

Sydney.

(Read at the 22nd Annual General Meeting, June, 1949.)

(Accepted for publication, 31/3/49.)

THIS article sets out some of the experiences gained in the treatment of the first 100 cases of bronchiectasis seen at the Bronchiectasis Clinic which was established at the Royal Alexandra Hospital for Children some three years ago. At that time it was realised that there was a problem which was peculiarly suited to the activities of a team. It was known that there were at least 40 cases of bronchiectasis in various departments of the hospital, and it was felt that some progress in their treatment might be made if these cases could be periodically reviewed by a group of people representing the various specialties concerned without establishing a special department in the hospital. The problem of these special departments or clinics is a common one in all hospitals, but presents rather special aspects in a Children's Hospital. Under our present hospital system it would be economically impossible for any member of the honorary medical staff to devote his whole hospital activities to such a restricted field as diseases of the chest, although this has been possible in some adult hospitals. The compromise was reached that the group concerned would act in a consultative fashion, would review only cases of established bronchiectasis proven by bronchogram, leaving the large field of pre-bronchiectasis and recurrent respiratory infections to the general physicians and that the surgery necessary would be carried out by one of the hospital's surgical teams.

The group consists of one physician, one surgeon and one otorhinolaryngologist and one anaesthetist, and the magnitude of the problem can be realised by the fact that already over 100 cases have been reviewed by this group and 25 patients have been subjected to lobectomy.

The patients are, in a sense, a selected group, in all of whom a history of infection in early childhood could be obtained. No cases have been seen associated with the inhalation of foreign bodies, and in such a group the problem of bronchiectasis associated with tuberculosis and newgrowth does not arise. It is not possible to present a typical picture of the child with chronic bronchiectasis, but the common conception of an emaciated child with copious amounts of foul sputum with dyspnoea, cyanosis and clubbing of the fingers has been very rarely seen and the psychological problems described by Adams (1947) as being associated with this disease, in which the patients are "struggling with a chronic disease with its influence on character and career," "labelled by the public as suffering from tuberculosis," with schooling neglected, "and named stinky by their schoolmates," have not been encountered in this clinic. Those are obviously the problems of an older age group, and in the main our patients have been happy and contented children carrying on more or less normal activities, apart from repeated pyrexial attacks with exacerbation of their symptoms and interruption of their schooling. Many have exhibited mild to moderate clubbing with cyanosis of the fingertips, which has disappeared under treatment and their chronic cough and sputum have been more an anxiety to their parents than to themselves.

It is recognised by most authorities that surgery offers the only prospect of cure in this disease, but it was realised that in such a chronic illness much can be done by medical and conservative treatment, both before and after operation, and that preoperative preparation is of paramount importance. It was therefore decided that the general supervision of these cases should be the province of the physician, and they remain under the care of their physicians, are reviewed periodically by the group, and owing to the excellent co-operation of the honorary medical staff it has been possible to plan different schemes of treatment for different groups.

Alexander (1944) estimates that about 50% of all patients with bronchiectasis do

not have surgical operations — some refuse while others have so little or so much lung affected as to contra-indicate operation, but there must be very few children in whom the diagnosis is made reasonably early, who, with adequate pre-operative management, will not be suitable for surgery.

Some of the objectives that have been set are to find answers to the following questions:

1. Can bronchiectasis be prevented?
2. Can bronchiectasis be cured by surgery?
3. Is established bronchiectasis ever reversible?
4. If surgery is the definite aim of treatment, what is the best course of pre-operative management?

ETIOLOGY.

It has long been recognised that bronchiectasis in children is preceded by one of the acute infections of the respiratory tract and is almost invariably accompanied by sinusitis. The pathological effects are well known, but why they occur is not so clearly understood. In the patients under review, it will be seen from Table 1 that over 80% had their primary infection before the age of two years. Contrary to the usual experience, the largest group had a history of bronchitis in infancy. These are the children "who cut every tooth with an attack of bronchitis," and it is difficult to over-emphasise the importance of these early infections.

Those following Pink disease form the group next in importance, and whooping cough, which is usually assessed as the most important infection of infancy, was the preceding infection in the third group. The usual predominance of females over males is seen, and there is no indication that any particular infection is followed by bilateral disease, the question of extent of lung involvement appearing to depend on the damage done at the primary infection.

TABLE I.

BRONCHIECTASIS CAUSATION — 100 cases 14/12/48.

Bronchitis in infancy	26
Pink disease (1 also pertussis)	17
Pertussis (13 under age 2)	14
Pneumonia (11 under 2)	12
Measles (3 also pertussis)	9
Indefinite	8
Tonsils and adenoids	4
Diphtheria	1
Unknown	9
	100
Males	35
Females	65
	100

Onset of primary infection before age of two.

Bronchitis	26
Pink disease	17
Pertussis	13
Pneumonia	11
Measles	7
Others	7
	81

PATHOLOGY.

Most writers seem to be agreed that the basic mechanism is damage to the bronchial wall. The common view is that damage to the bronchial wall occurs at the time of the initial infection and the development of bronchiectasis is largely dependent on bronchial obstruction.

Any condition interfering with the free flow of air from bronchi to alveoli will cause collapse of the lung, which is relatively common in children. This may be followed by bronchiectasis; the bronchi are surprisingly small and easily blocked by thick mucus which is a common accompaniment of respiratory infections. Many of these atelectatic cases are truly reversible and cases are described in the literature (Findlay, 1935) (Lander, 1946), where bronchiectasis demonstrable by lipiodol injection has been shown to completely disappear with re-expansion of the collapsed lung. In such cases the damage to the bronchial wall must have been minimal, as it does not appear possible for true reversal to occur where the musculo elastic tissue of the bronchial wall has been destroyed.

Some writers think that bronchiectasis is the inevitable consequence of infection of the bronchial walls and collapse of the alveoli beyond (Palley, 1948), but that if treated at the appropriate time, can be prevented. If the lung does not expand rapidly with breathing exercises, bronchoscopy should be undertaken to remove the obstruction, which is generally inspissated mucus.

The following case illustrates the beneficial effects of bronchoscopy employed during

a subacute lung infection (Hughes and Coutts).

CASE 1.

A baby of eight months was admitted with a history of difficulty in feeding and recent acute upper respiratory tract infection. Feeding was supervised with moderate improvement over a period of six weeks, but the cough persisted with very severe spasmodic attacks and slight pyrexia. The baby began then to lose weight, and after a further two weeks, X-ray examination showed "some patchy dullness in the right lung, particularly towards the base, and also just above and external to the right hilum. The changes suggest the possibility of bronchopneumonia. The aeration in the left lung field is definitely more marked than in the right and the appearance suggests the possibility of a transradiant F.B."

Bronchoscopy was undertaken and the findings were "Carina thick and rounded. Right bronchus filled with thick, ropy secretion, sucked out with difficulty. Right lower bronchus was narrowed with oedema. No F.B. seen. Five drops of 10% Argyrol instilled. Left bronchus wider and little secretion."

This procedure was followed by gain in weight and improvement in general condition and the baby was discharged one week later.

That bronchial obstruction and infection are not the only factors involved in causation is evident from the fact that comparatively few patients, who have these respiratory infections in childhood, develop bronchiectasis. To explain this, Engel (1947) postulates an inherent weakness in the bronchial wall occurring in some individuals — congenital bronchomalacia. This consists in a lesser development of the bronchial wall, which is thinner than normal and its constituents are immature. These conditions always apply to a certain degree in infants and children, but there are also constitutional variations in strength analogous to the poor development of cartilage in the epiglottis, causing the condition of congenital laryngeal stridor. He also considers that only those patients suffering from bronchomalacia are in danger of developing bronchiectasis following lobar collapse due to blockage of a local bronchus, and in support of his ideas he was able to demonstrate poor development of the bronchi in an infant suffering from congenital cystic lung. However, he admits that bronchi of normal structure may undergo pathological changes which lower their strength and resistance, as is commonly seen after bronchitis. Heavy infiltration of the bronchial wall occurs and reduces its strength so that dilatation, especially in the medium and small bronchi, and even more prominently in the bronchioles, occurs. This is referred to as acquired bronchomalacia. Widespread weakening of the bronchioles may occur or the damage may be limited to one or more lobes, depending on the grade and extent of lung involvement at the time of infection. Acute bronchomalacia and bronchodilatation are often temporary. He states that localised bronchitis is more common than a general inflammation and is chiefly located in the lower lobes, which are the commonest site of bronchiectasis. When the condition becomes chronic, dilatation becomes permanent and bronchiectasis follows. It appears that some of the generalised cases can be explained on the theory of a congenital weakness of bronchial structure, but that the vast majority are "acquired", the infection being in the first two years of life in a previously healthy infant.

FIGURE I. Case 2. D.M.: 3 years. Widespread bronchiectasis following whooping cough.

CASE 2.

This case illustrates the severe constitutional symptoms that may be present in a young child without a great deal of X-ray evidence of lung involvement. D.M., aged three years, was reviewed at the Clinic on 18/7/47. There was a history of chronic cough since eight months, when she had whooping cough and pneumonia, and never lost the cough from that time. She had never thrived and on many occasions her cough had become worse with pyrexia and rapid breathing. She was a thin-wasted child with cyanosis and marked clubbing of the fingers. Rales were heard over both lungs anteriorly and posteriorly. X-ray examination of the lungs showed extensive congestion involving the whole framework of the lung. There were tiny areas of consolidation or atelectasis throughout the whole of both lung fields. Bronchogram showed the bronchial tree well filled with some slight dilatation of most of the bronchi and a moderate amount of pus was sucked out from each side at the bronchoscopy. The bronchoscopic suction was repeated weekly for four weeks. She was given penicillin aerosol inhalations and 2/3 tablet of sulphathiazol eight-hourly. After a month's treatment she was sent home and the sulphathiazole was continued.

This is a severe case of bronchiectasis for which surgery has not much to offer, but it is likely that with a long period of medical treatment she may be kept in fairly good health. There is generalised involvement of both lungs and it is an attractive explanation for such a case to suggest that there was a congenital weakness of the bronchial structure.

The following case illustrates the degree to which the lung may be affected and the rapidity of development of the established condition.

CASE 3.

W.M., a previously healthy male child, was admitted at the age of one year and ten months with a six-weeks illness following measles and pneumonia. Cough persisted and there was deficient aeration of the right lung. Plain X-ray examination showed the right lung to be completely atelectatic with possibly multiple bronchiectatic cavities through the whole lung. Bronchoscopy was attempted unsuccessfully, following which procedure laryngeal oedema developed, necessitating intubation, after which a considerable amount of pus was coughed up. The child improved and was discharged from hospital two weeks later. He was re-admitted two months later with a history of high fever and constant cough. The acute phase subsided with sulphonamide therapy and he was discharged four weeks later. He continued in indifferent health for ten months, with the comment that he was not very co-operative with postural drainage. Intermittent febrile attacks continued for over two years and he was again admitted to hospital with a more than usually severe attack. His history now was that he coughed up a cupful of sputum daily — very offensive — and bronchogram showed the appearance of gross bronchiectasis of the whole of the right lung.

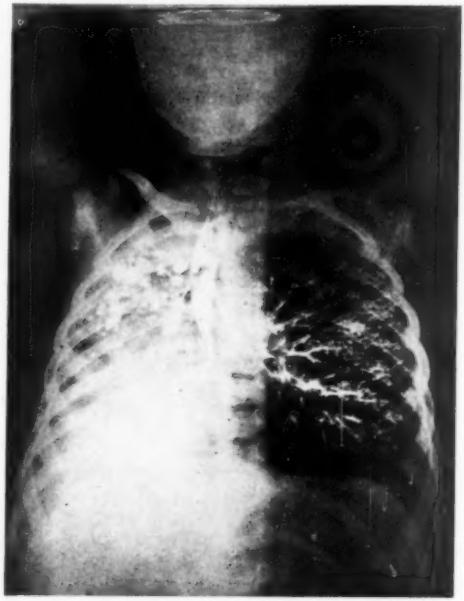

FIGURE II. Case 3. W.M.: Gross bronchiectasis of right lung at age three following measles. Left lung not affected.

Right pneumonectomy was performed at the age of five and he has been symptom-free since.

In view of the early origin of this case and the extensive nature of the disease, it was thought that this child might be suffering

from congenital cystic disease, but examination of the lung removed showed gross uniform dilatation of bronchi throughout the whole lung, the dilated bronchi being lined by hypertrophic epithelium with thick walls of granulation tissue largely replacing the specialised tissues — the picture of chronic bronchiectasis.

This is the most advanced case we have seen and illustrates the fact that bronchoscopy of these small infants is a technical procedure of the greatest difficulty, but that such cases can be carried on over long periods with conservative treatment and finally be cured by surgery. Even if bronchoscopy had been successful in the early stages, it seems unlikely that such a case would have been cured by this procedure in view of the widespread damage to the bronchial wall that was present.

It is evident that well-established bronchiectasis was present six weeks after the initial infection, and this case would fulfil the requirements of Engel's "acquired bronchomalacia." It is of interest in this connection that Spain (1948) reported a case of bronchiectasis seven weeks after inhalation of a screw and states that other cases have been reported in which the condition has developed in from four to six weeks.

CYSTIC DISEASE AND CONGENITAL BRONCHIECTASIS.

These are different manifestations of one underlying process—i.e., agenesis or arrested development. The development of the bronchial tree may be arrested at any stage and already existing elements may continue to grow without further differentiation (Bowden, 1948). This explains the various forms that congenital cystic disease may assume and the congenital nature of the disease is evidence by finding the cysts lined by ciliated or cubical epithelium, although Price (1948) maintains that bronchial epithelium may be found as the lining of a chronic abscess cavity. Gross (1946) maintains that cysts appear occasionally as a result of inflammatory reactions, although this is denied by Bowden. The latter also describes a type in which cystic spaces are found with a flattened lining morphologically resembling lymphatic spaces. It is suggested that the following case may be of this type.

CASE 4.

Anne N., aged seven months, was admitted with a diagnosis of pneumonia. There was dullness at the right base and thick pus was found with an exploring needle in the right

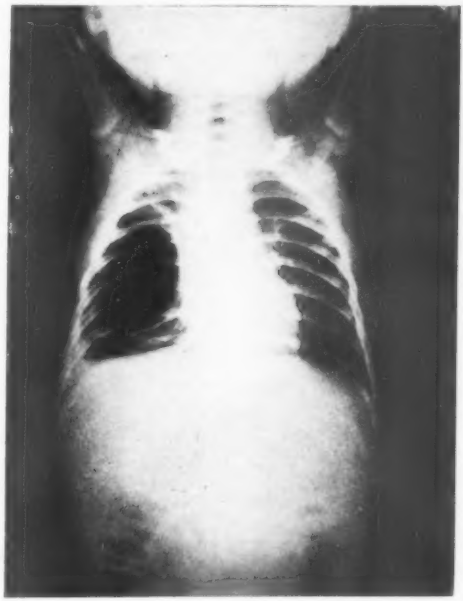

FIGURE III. Case 4. A.N.: Large cyst on right side with collapsed lung.

axilla. This pus yielded a pure culture of staph. aureus-penicillin sensitive and treatment was carried out by injection of penicillin into the cavity through an intercostal catheter with intermittent negative pressure drainage.

The catheter was removed on the ninth day and the X-ray appearances were those of a large cyst which was now air-filled, producing collapse of the right lung. There was no change in the radiographic appearances in the next two months, and it appeared that pneumonectomy would be necessary. However, the child was perfectly well and in no respiratory distress, and it was decided to observe the child's progress in the outpatients' department. Two months later X-ray examination showed a completely clear lung field with no evidence of a cyst and a fully expanded lung.

It is known that solitary cysts, if they communicate with the bronchial tree, may become surgical emergencies if tension of

the enclosed air becomes increased, as was seen in the case of Gross (1946) and also that of Brown (1948), but at no time did this child show any evidence of increased intrathoracic pressure.

Cystic disease may exist for years without any clinical manifestations, but the following case illustrates the co-existence of well-marked bronchiectasis in one lung with cysts in the other lung not as yet demonstrably associated with bronchiectasis.

FIGURE IV. Case 4. Lateral view showing loculation.

CASE 5.

Jennifer A., aged seven years, presented the picture of well-developed bronchiectasis affecting the left lower lobe. There was also X-ray evidence of cysts in the right lung. Lobectomy of the left lower lobe was performed and the removed portion of lung showed saccular dilatation of the bronchial tree. One large cyst which did not communicate with the bronchi was lined by columnar epithelium, which rested on a layer of fibrous tissue. She still has fairly copious sputum and it is probable that bronchiectasis does exist on the unoperated side, although not demonstrable by bronchogram.

PREVENTION.

This depends on adequate treatment of the acute infections of childhood. Since bronchial obstruction is such an important factor, every effort should be made to prevent collapse, or if it occurs, to remove the obstruction. Many cases will re-expand by themselves or with the institution of breathing exercises, but if these measures fail, there is a clear indication for the bronchial tree to be freed by bronchoscopy. The use of gamma globulins and convalescent serum in measles should be considered in young children, especially if exposed to or convalescent from whooping cough or pink disease. Penicillin and sulphonamides may be of use in the acute phase. The importance of maintaining improvement in cases of the established condition was responsible for the development of the Meath Hospital School in Surrey (White, 1948), where patients undergo a routine of physiotherapy school, and if necessary, postural drainage.

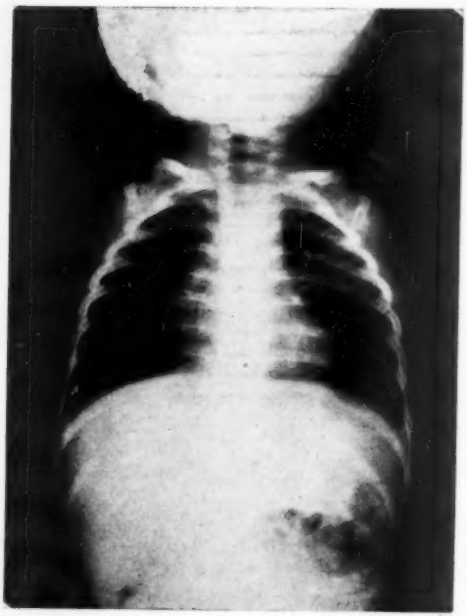

FIGURE V. Case 4. Appearance two months after discharge.

It is hoped that when the hospital building programme in this State develops, it will be possible to arrange for a convalescent hospital in the hills near Sydney, attached

to the Children's Hospital, to provide treatment for early cases of this disease.

FIGURE VI. Case 5. J.A.: Bronchiectasis of left lung. Plain ray showing cysts in right lung.

TREATMENT.

The plan that has been evolved is to assess the clinical condition of the patient at the first examination and estimate the degree and extent of lung involvement by examination of the bronchogram. Important information is gained by the bronchoscopist at the time the bronchogram is made, and a fair idea of the severity of the condition may be formed by the amount of pus sucked out of the bronchi. This point was emphasised by Dr. Norman Meacle, who has been responsible for the excellent bronchograms illustrated and has been responsible for the bronchoscopic treatments. The patient is then admitted to hospital for a month's intensive treatment, during which time he is trained in the performance of postural drainage and is taught breathing exercises. Bronchoscopic suction is also performed once weekly with lavage until the return is clear and instillation of 4 c.c. penicillin, 500 units to 1 c.c. During the stay in hospital penicillin is administered by the aerosol method daily, 30,000 units being given three times daily.

At the end of this period the patients are placed into one of three groups. In the first the patients continue at home with postural drainage and exercises and are given small doses of sulphathiazole. The dosage used is 1 tablet (.5g) eight-hourly for those over five years, and 2/3 tablet eight-hourly for those under five. This is regarded as pre-operative treatment and has been continued for as long as twelve to eighteen months with definite improvement in the patients' condition. With regard to selection of cases for surgery, those cases have been picked first who seemed most in need, and this has naturally resulted in the older patients being the first to be selected. It also gives a rather large proportion of bilateral cases. The striking fact has emerged that very few of these cases have failed to show improvement during this "waiting" period and is evidence that at the time of diagnosis the extent of the lesion is usually determined, and that with reasonable, conservative treatment, the process does not spread to involve other parts of the lung. The improvement has been so marked that it has come to be

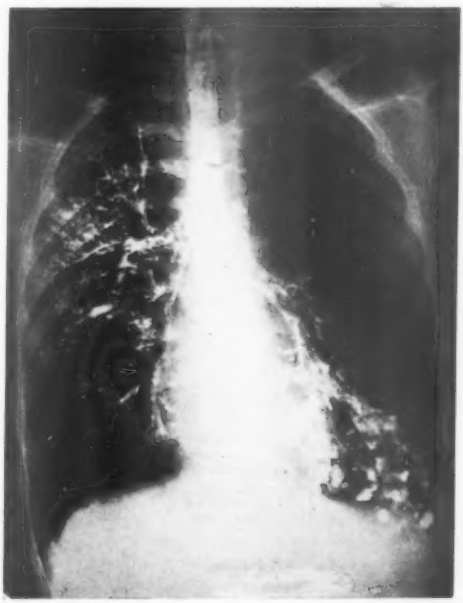

FIGURE VII. Case 5. Bronchogram showing affected left base with lung cyst.

regarded as desirable that a long period (i.e., months) of conservative treatment should precede operation. In a few cases the improvement has been so marked that operation has been refused, and when the patients do come to operation, it is felt that they are in the best possible condition. When this plan was started, some doubts were felt as to the wisdom of the prolonged sulphonamide therapy with the attendant risks of producing sensitisation and development of resistant organisms, but it is due to the enthusiasm of Dr. Donald Vickery that this plan was followed. The experience gained in the U.S. Navy (Lehr, 1948) in the control of streptococcal infections by sulphadiazine indicates that sensitisation is not produced by prophylaxis and that there is no difficulty in obtaining a therapeutic response in streptococcal infections. Rosenberg also, in the Rheumatism Centre of the U.S. Army, found no sensitisation and could find no evidence that virulent drug fast strains might result from prolonged prophylaxis. While this method of preventing febrile episodes in bronchiectasis has received scant attention in the literature (White, 1948) (Allan, 1948), the experience in this series of cases has certainly been very favourable and the patients have nearly all shown considerable improvement and respiratory infections have been kept at a minimum.

The second group has been subjected to repeated bronchoscopic aspiration as a form of treatment while awaiting operation and after the initial month's treatment in hospital. This group is necessarily limited to those patients within easy access of the hospital and, while not comparable in numbers to the first group, has shown a similar satisfactory improvement in the clinical condition. Aspiration is carried out once a month and postural drainage and breathing exercises are continued. The one case regarded as being cured without operation was in this group.

A third, smaller group has had no treatment after the first month other than postural drainage and exercises, and has consisted mainly in children living inland in a dry climate, which in itself may be regarded as a form of treatment calculated to produce the best conditions for preventing respiratory infections.

A few patients forming the fourth group were considered fit for lobectomy without any waiting period. These results are shown in Tables II and III.

TABLE II.

BRONCHIECTASIS DISTRIBUTION.

	Grp. 1.	Grp. 2.	Grp. 3.	Grp. 4.	Total
Double . . .	26	12	6	2	46
Left base . .	14	8	4	2	28
Left base and lingula . .	10	7	4	0	21
Right base . .	1	1	2	1	5
	51	28	16	5	100

Of the first group, one had right basal lesion and was treated by bronchoscopic suction and no operation. One had the right lower lobe removed. One had the right middle and lower lobes removed. One had right pneumonectomy. One had left lower and lingula removed. Of the third group, six were treated by sulphathiazole continuously, five by bronchoscopic suction and one with cystic disease had no accessory treatment. Nine were bilateral and three unilateral.

TABLE III.

BRONCHIECTASIS RESULTS.

Follow-up on 71 cases. (15 too recent to assess — 14 left Clinic.)

1. Symptom free	5	
2. Improved	52	(75%)
3. Not much improvement	12	
4. Deteriorated (deaths)	2	

RESULTS OF CASES TREATED BY LOBECTOMY.

Of the cases subjected to operation (25), only four are unequivocally cured. There was one death after left pneumonectomy for extensive bilateral disease. The death occurred thirteen months after operation, but the child had never improved much and continued to have attacks of pneumonitis on the unoperated side.

Fifteen cases show considerable improvement. Nine are unilateral cases, but the suggestion is that there may be still residual parts of the lung affected. This group illustrates the necessity for post-operative treatment for a long period and regular review. Six are bilateral cases and will be subjected to further operation at a later date.

In four cases there has been no significant improvement — three were bilateral cases and one unilateral.

It would be impossible to assess the results of these operations without taking into account the uniformly excellent anaesthesia provided by Dr. Distin Morgan, and it is not too much to say that it is successful anaesthesia that makes these operations possible.

TABLE IV.

RESULTS OF LOBECTOMY.

26 operations in 25 patients.

4 cured	1 right pneumonectomy
	1 right lower and middle lobes
	1 right lower lobe
	1 left lower lobe
15 improved	9 unilateral
	3 left lower and lingula
	6 left lower lobe
	6 bilateral
	5 left lower and lingula
	1 left lower lobe
4 not much improved	
	3 bilateral
	1 left lower and lingula
	2 left lower lobe
	1 unilateral — left lower lobe

1 child died thirteen months after operation

1 too recent to assess.

COMPLICATIONS.

There were no cases of empyema, and with the routine pre and post-operative use of penicillin, this may now be regarded as a rarity.

In some cases there was delay in expansion of the operated lung. While some cases can be carried along with occasional aspiration through a nasal catheter, the present procedure is for all cases to have bronchoscopy performed on the third post-operative day.

CONCLUSIONS.

1. There is justification for considerable optimism in the treatment of bronchiectasis in childhood, as this represents the most favourable period for successful treatment to be undertaken.

2. Children stand lung operation well and with modern technique and modern anaesthetic methods, lung resection can be undertaken with reasonable safety and with a prospect of great improvement, if not cure.

3. It is considered that a long period of conservative treatment should precede operation to enable the patient to face the hazards of lobectomy in the best possible condition.

4. Bronchiectasis may be preventible in the early stage if a chronic cough which occurs in the teething period following bronchitis, pink disease, whooping cough or measles receives adequate convalescent care. Bronchial obstruction should not be allowed to persist, but the bronchial tree should be cleared by bronchoscopy in a persisting lung infection after one of these acute diseases.

Dr. Reye has been good enough to write the following comment on the specimens removed at operation.

Pathological report on operative material submitted for examination between 24/7/45 and 30/11/48.

Material. Twenty-four specimens from twenty-three patients. In the survey attention was directed to:

(A) The bronchi;

(B) The lung parenchyma;

(C) The presence or absence of structures which could be identified as isolated cysts.

(A) *The bronchi.*

(*a*) Firstly, an attempt was made to define the degree of active inflammation present; no distinction was drawn between acute reactions with abundant polymorphs and subacute and chronic inflammatory changes with abundant cellular granulation tissue; acute exudative reactions were never present as the sole evidence of inflammation. Determined on this basis active inflammation, as indicated by the extent of active granulation tissue and inflammatory cellular infiltration of the bronchial walls was marked in 17 specimens, moderate in four specimens and slight in three specimens.

(*b*) Secondly, the number of eosinophile leucocytes present in the inflamed walls. This was marked in one specimen, moderate in three specimens, slight in four specimens and absent in 16 specimens.

(*c*) Bronchial epithelium. In all but three specimens there was a complete

epithelial lining to the lumen of the inflamed and dilated bronchi. In two specimens granulations alone formed the inner lining of at least a proportion of the inflamed tubes and in one specimen there was a patchy necrosis of the inflamed bronchial wall. The lining epithelium was thickened in all specimens in which it was present; squamous metaplasia of the epithelium was not found in a single example.

(B) *The lung parenchyma.*

Excluding peribronchial fibrosis which was present to a varying degree in all specimens, there was marked parenchymal fibrosis in four specimens, moderate fibrosis in eleven specimens, slight fibrosis in six, and no parenchymal fibrosis in three. Even in the specimens in which fibrosis was marked or moderate, it did not involve the lobe uniformly and was always most marked in areas of collapse.

Additional parenchymal changes. Areas of bronchopneumonic consolidation were present in four specimens. Patches of unresolved pneumonia were present in two specimens. Large necrotic foci were present in (one) specimen. Lipoid material and/or foam cells were found filling a variable number of alveoli in eight specimens.

(C) *Cysts.*

Only discrete cavities having no detectable communication with the remainder of the bronchial tree and lined by bronchial epithelium were included in this category. Sacular out-pocketings or terminal expansions of the bronchioles were not included. Using the above criteria isolated, cysts were found in four specimens.

In one of these four cases there was only one large unilocular cyst lined by bronchial epithelium and having a wall which contained smooth muscle. Sacular dilatations of the terminal bronchi were marked in this case.

Apart from the four specimens listed above, there was in one what appeared to be greatly stenosed bronchi producing isolated bronchial segments filled with mucus and resembling cysts. In another example there was evidence of early occlusion of the bronchi in some parts by ingrowth and union of opposing segments of granulation tissue.

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THE INTERDIGITAL PILONIDAL SINUS.

By E. S. J. King.

Melbourne.

(Accepted for publication, 3/5/49.)

THE term "pilonidal" was applied first to sinuses and cysts in the sacrococcygeal region by Hodges in 1880. Indicating a "nest of hair", it was a particularly happy choice since on the one hand it was an apt and adequate description and on the other it did not commit a user to any hypothesis regarding etiology. This term has been employed by most American writers but the condition to which it refers has been recognised by British and Continental observers mainly as the sacrococcygeal sinus or cyst.

As has occurred with so many conditions, from the time of the early observations, the sacrococcygeal sinus has been regarded as arising by some "error" of foetal or embryonic development. This view appeared to be supported by the occasional observation of post-anal dimples and the less common cutaneous pits in new-born babes.

Various forms of the hypothesis have been proposed to account for the condition, such as lack of fusion at one point in the neural folds or defect in development of the neuenteric canal. As one suggestion became untenable some other was propounded. The important point appeared to be the necessity for retaining some notion of a "defect" of development. Every argument that could support this idea was exploited to the full.

During the War years, the writer had the opportunity of observing many sacrococcygeal sinuses and found that there were several readily demonstrable phenomena which did not conform with any hypothesis based on an antenatal origin. These observations and deductions made from them have been described in an earlier paper. It might be emphasised here that it is not suggested that all cases are of post-natal development. Some are present at birth but these constitute a small minority and should not be allowed, without sufficient supporting evidence, to determine ideas about the majority. Patey and Scarff (1946, 1948) considered this question and concluded that the condition usually arose in post-natal life. Of particular interest was their observation of sinuses occurring in the hands of barbers.

Recently, Smith (1948) has recorded cases of pilonidal sinuses found in the perineum and anterior to the anus. He noted specially that these did not necessarily lie in the midline — a point regarding sacrococcygeal sinuses noted by the present writer. Smith, for obvious embryological reasons, discarded most "congenital" hypotheses but retained the notion of the sinuses being homologous with such structures as the scent glands of animals such as the carnivors and the musk gland of the duck. It is difficult to see how speculations on such hypothetical homologies can have any serious pathological significance.

In the last four years, the writer has seen several cases of pilonidal sinuses in the interdigital spaces. These sinuses show morphological appearances which are characteristic of those in the sacrococcygeal region — a pit of variable depth, lined by granulation tissue or epithelium, containing hair and liable to infection with formation of abscess and secondary sinuses. Though, as remarked by Patey and Scarff (1946), these are relatively common there appears to be, apart from their account, no adequate current description. Mention of them has been made by Ewing, Sames, Tait and Wilks. Since they throw considerable light on the origin of pilonidal sinuses elsewhere, some cases are described.

Case Histories.

Case 1. Male, aet. 72 years, had been a barber for most of his life. During the last four years he had had infections in the web between the middle and ring finger of his left hand (he thought on three occasions). There had been a small pit in the skin between the fingers for two to three years; he had not noticed it earlier. He remarked that customers' hair which lodged on the fingers gradually moved towards the hand

and often accumulated between the fingers at their junction. These collected particularly in the small pit.

He found that if he removed these hairs with a pair of tweezers after each hair cutting session he had very little trouble but if he failed to do so, then soreness and infection of the region occurred. Since the importance of the presence of hair was emphasised to him, he had placed (during hair cutting) a piece of strapping over the web containing the pit and he had not had further trouble.

O.E. There was a small pit about ¼" deep and with an opening of ⅛" in diameter immediately behind the web between the middle and ring fingers (Figures I and II).

It appeared to be lined by skin. There were some scars on the back of the hand between the middle and ring knuckles showing where abscesses had burst with subsequent healing. On several occasions when the protective dressing was not applied (during business hours) the pit was found to contain a number of hairs. These could be removed readily and were short, with cut ends and without any roots. The colour corresponded with that of his recent customer — clearly the hairs had come from his client's head.

FIGURE I. Photograph of the left hand of the patient (Case 1), showing the pit in the skin just dorsal to the web margin between the middle and ring fingers. A small scar indicating where an abscess had opened a little behind this on the back of the hand is discernible.

Case 2. Male, aet. 42 years, a barber, had had an "abscess" developing in the web between the middle and ring fingers of the left hand for three days. He had had a similar condition two years prior to this

FIGURE II. Photograph of the web area of the hand shown in Figure I, showing the pit containing projecting hairs and the scar on the back of the hand.

and it had recovered following an incision in the back of the web. He said that several of his fellow barbers had the same kind of condition.

O.E. There was a red, very tender, thickening of the web between the middle and ring fingers. There was a small shallow pit in the skin just dorsal to the web (midway between the two fingers) and there was a pale linear scar over the most prominent part of the swelling.

Incision of the swelling allowed the escape of a small amount of pus with subsequent resolution.

Some minute pieces of hair were found actually embedded in the skin of the index and middle fingers, particularly in the web (Figure III).

Case 3. Male, aet. 37 years, barber, had had several "attacks" of painful swelling between the middle and ring fingers of the right hand. He had never had an incision of the inflamed area but on several occasions

there had been an escape of pus from an opening just behind the web margin, after which the area returned to normal.

O.E. The pit was found to be ½" in depth with a small opening and no obvious foreign body was detected. Excision of the sinus was performed.

FIGURE III. Photograph of the index and middle fingers (Case 2) showing many small hairs embedded in the skin, particularly in the region just dorsal to the web margin.

Pathological examination: The specimen consisted of an ovoid piece of skin, in the middle of which there was a pit projecting into the underlying connective tissues. On incision this pit was found to contain a few hairs, which did not possess roots and were cut off short.

Histologically, the pit was lined by squamous epithelium and a few hairs were present in the cavity (Figure IV).

Case 4. Male, aet. 53 years, barber, had had intermittent attacks of pain and swelling between the first and middle fingers of the left hand. He had noticed a small pit in the skin of the web and that customers' hairs were often in it. These he usually removed at the end of the day's work. The swelling was confined to the region of the pit and when present was very tender. Redness of the adjacent skin developed but there had been no discharge of pus at any time.

FIGURE IV. Photomicrograph of a section through the deep portion of a pit showing the squamous epithelial lining and the hairs which are seen to be cut off short. x 30.

O.E. There was a well defined pit in the skin just dorsal to the web margin between the left middle and ring fingers. The pit was found to contain a few short pieces of

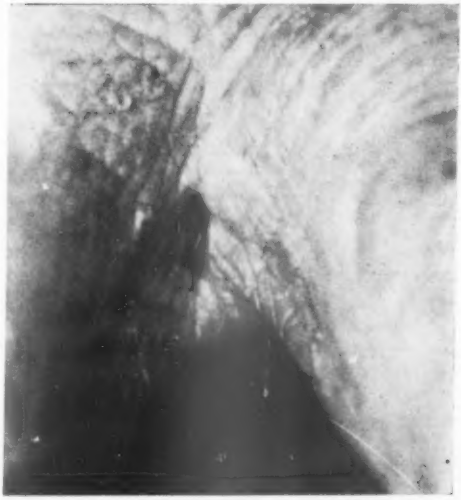

FIGURE V. Photograph of the web area between first and middle fingers (Case 4) at close view, showing a well-defined pit containing hairs which are projecting from the orifice.

hair (Figure V). Pressure on the proximal part of the web caused the escape of a small amount of cloudy fluid from the orifice of the pit. Excision was recommended but the patient preferred to rely on conservative treatment in the form of a protective covering.

DISCUSSION.

These cases illustrate some of the forms which this condition may take and also indicate their mode of formation. They arise clearly as the result of the special circumstances of the men's work.

The penetration of the skin by short pieces of hair is well shown in Case 2, and this observation can be made frequently. If these individuals are observed at work, hairs are seen to accumulate in numbers between the fingers; indeed they appear almost to flow towards the interdigital space. Furthermore, once even a small depression is formed the hairs in the region find their way into it.

Some of the hairs which become embedded in the skin (Figure III) give rise to an infection and thus a small opening in the skin begins. If this is just behind the web, one or more hairs will enter it, perhaps only temporarily, but as the result of repeated insults the opening persists and becomes larger. Epithelialisation of such a depression or pit is a commonly observed phenomenon. Finally there is thus formed a well defined crypt or pit from which usually a few hairs may be seen to project.

Pits of this kind are to be found in various parts of the body. The best known are the sacrococcygeal sinuses and the perineal type mentioned above. Their occurrence in other places where folds of skin form a well defined crease or groove was mentioned by the writer in an earlier paper (King, 1947). These last occur particularly in relatively hirsute areas and where movement between the folds occurs often. This supports the suggestion of Patey and Scarff (1948) that the entrance of hairs into a pit is facilitated by a suction action.

From the above features it is clear that the usual view regarding sinuses of this kind must be broadened. Several characteristics may be stated: i. Pilonidal sinuses are found in many areas. ii. In any of these areas they do not have a specific site but the site may vary from case to case within the area. iii. They occur at all ages. iv. They develop under observation and in an area previously normal, and v. The hair in the sinus is extraneous and indeed need not necessarily belong to the same individual.

The interdigital sinuses are obviously post-natal in formation. Not only is this clear from the history of the cases and other features mentioned but also there is no apparent embryological basis for their development in antenatal life. They are important in that they suggest the nature and mode of formation of the sacrococcygeal cysts.

The sacrococcygeal cysts exhibit all the features mentioned above. In this case the hairs come from the back of the individual and their entry into a forming or formed sinus can be prevented by application of an appropriate dressing. Sinuses in this region may possibly begin by penetration of the intact skin by a loose hair but this has not been observed by the writer as it has with the interdigital examples. On the other hand early stages of the developing crypt can be shown to be enlarged hair follicles (King, 1947). The important point is that once the crypt begins to form the process will proceed in the manner described above.

The conclusion that sacrococcygeal cysts were due to extraneous factors and in the vast majority of cases are of post-natal development was arrived at from consideration of a series of these sinuses but the observation of sinuses in other parts of the body such as those described here throws confirmatory light on it.

SUMMARY.

1. The interdigital sinuses constitute a well defined clinical and pathological entity.
2. They are clearly of post-natal origin and the environmental factor responsible for them is dependent on the patient's occupation.
3. The hairs contained in the sinuses are of extraneous origin.

4. The close similarity of the features of these and other sinuses to sacrococcygeal sinuses indicate that their general mode of development is similar. Thus the various hypotheses relating these last to "developmental anomalies" should be discarded.

ACKNOWLEDGMENTS.

The first of these cases was introduced to me nearly four years ago by Mr. Graham Godfrey to whom I would express my thanks and appreciation of a shrewd observation.

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NERVE SHEATH TUMOURS OF THE VAGUS NERVE IN THE NECK.

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(Accepted for publication, 21/12/48.)

NERVE sheath tumours of the vagus nerve in the neck are so rare, every case is worthy of record. Murley (1948) described a case and could trace the records of only four other cases in the literature. There were, in addition, records of three cases in which the nerve of origin of the nerve sheath tumour in the neck could not be accurately determined. The difficulty of identification of the nerve of origin is enhanced by the absence of signs of interference with the function of the nerve, and as a result the nerve of origin can only be determined when the tumour has been exposed at a surgical operation, provided that the exposure made permits of such identification. Interference with function would occur if the tumour became malignant and invaded and destroyed the fibres of the nerve, but Stout (1935) in a review of the literature found no case of vagus nerve tumour which had become malignant. He records a case of his own, a malignant paraganglioma of the ganglion nodosum of the vagus nerve. In 1940, however, Furber and Fox recorded a case of perineural fibrosarcoma of the vagus nerve. The experience of so small a series of cases of vagus nerve tumours is too limited to justify the drawing of conclusions in regard to the possibility of malignant changes occurring in any individual case. Such a question might be decided by reference to those features which are known to influence the incidence of malignant degeneration in nerve sheath tumours. Such considerations would have important practical bearings on the scope of the operative treatment of these cases. If the tumour is potentially malignant, excision of the tumour with the nerve trunk should give the best chance of freedom from recurrence. Murley (1948) excised the vagus nerve in the neck for these reasons. The patient lost his voice after the operation, but suffered no other disability. Gordon Taylor (1940) excised the vagus nerve in the neck in five cases of carotid body tumour, and in these cases the only sequel was loss of voice from paralysis of the vocal cord. Gordon Taylor did not confirm the estimates of previous writers that bronchopneumonia would follow, with a mortality of twenty per cent. The vagus nerve interlaces so completely with its fellow of the opposite side below the level of the neck that division of one nerve in the neck should not interfere with the function of the vagus plexus. This is borne out by the effects of vagotomy for gastric and duodenal ulcers. The sparing of a single strand of the vagus nerve plexus at operation will suffice to result in continuance of the secretion of hydrochloric acid. Division of the vagus nerve in the neck, however, carries the price of loss of voice, and this in itself is a serious loss. The function of the nerve trunk might be preserved if the tumour were enucleated from within its capsule, but this would only be safe with tumours which were not potentially malignant. Extra-capsular dissection of a nerve sheath tumour might offer a better prospect of freedom from recurrence than an intra-capsular enucleation, but there would be an increased risk of damage to the nerve trunk, a risk which would be considerable in the case of such small nerve trunks as the vagus nerve.

The decision as to the method of treatment most appropriate for a particular case would be easier to make if it were possible to determine whether the tumour in any particular case were innocent or potentially malignant. Verocay (1908) was the first to attempt this distinction. He described two types of nerve sheath tumours, the differentiated tumours which he believed originated in the neuro-ectodermal tissues of the nerve sheath, the sheath of Schwann, and the undifferentiated tumours which he believed originated in the mesodermal connective tissues of the nerve sheath, the endo and perineural sheaths. The differentiated tumours were innocent, while the undifferentiated were potentially malignant, and not uncom-

monly became sarcomatous. These ideas have had many supporters. From the histological point of view, Masson (1932) brought forward good evidence for supporting the neuroectodermal origin of the differentiated tumours. Stout (1935) made a careful analysis of a series of cases to show that the non-differentiated tumours were very liable to become malignant, while the differentiated tumours hardly ever did so.

If these views be accepted, it is important to consider whether the differentiated and the non-differentiated tumours could be recognised from a clinical examination of the patient, and whether the differentiated and the non-differentiated tumours could be clearly distinguished on histological examination to enable the prognosis of a case to be correctly assessed when a tumour had been excised. The differentiated tumours have been described as solitary tumours growing in the sheaths of large nerves, while the undifferentiated tumours were identified with the multiple growths found in cases of Von Recklinghausen's disease. Careful search must be made for unobtrusive coffee-coloured patches of skin and for small, inconspicuous nodules on nerves. A diffusely nodular nerve trunk would be found in the plexiform neurofibromatosis type of Von Recklinghausen's disease.

Unfortunately there is reason to doubt whether this clinical distinction is accurate. There is insufficient evidence to support the view that all solitary tumours are differentiated and innocent, and that all multiple tumours are undifferentiated, potentially malignant and occur in patients with other signs of Von Recklinghausen's disease.

The other method of assessment, the histological appearance of the tumour, has proved to be equally fallacious. Despite the careful work done on this subject, histological methods cannot differentiate between fibroblastic tissue derived from neuro epithelium, and fibroblastic tissue derived from mesoblast. Neither the cells nor the fibres are distinctive, and the position that there are two types of tumour of separate origin is one that cannot be accepted without reserve. Despite these doubts, an attempt should be made to classify the tumours in order to provide a basis for testing the accuracy of these views. The most practicable histological classification is that of Antoni (1920), who describes two types of tissue in the differentiated tumours: type A tissue, which is the typical differentiated tissue described by Verocay, and type B tissue, which is derived from type A tissue by microcytic degeneration causing some of the cells and fibres to be replaced by fluid. The compact type A tissue, with long bundles of non-branching, wire-like fibres bordered by clumps of cells with elongated nuclei arranged in palisade formation, gives an easily recognisable histological picture. The type B tissue, with recticular wire fibres running between irregularly disposed cells, has to be carefully distinguished from the broad collagen bands of the undifferentiated tumours with bands branching around individual cells.

Using these criteria for classification, nerve tumours can be arranged in two classes, the differentiated and the undifferentiated tumours. Whether the classification is of value in assessing the innocent or potentially malignant nature of an individual tumour is a question needing further work to determine and individual cases will have to be followed up to assess the accuracy of such a classification and to confirm or refute the value of Stout's (1935) conclusions in this regard.

Case Report.

N.M.K., aged 31, male, unmarried Singalese, was admitted to the General Hospital, Colombo, on 17/7/48 on account of a lump in the neck of six years duration. At its first appearance the tumour had been the size of a marble, and it had steadily increased in size since then. There had been no pain in connection with the tumour. On examination a spherical tumour the size of a billiard ball was seen and felt in the neck above the inner end of the right clavicle. Firm pressure on the tumour caused pain radiating up to the head and right eye and down to the epigastrium. The larynx and trachea lay against the tumour, the trachea being deviated by the tumour to the left at the base of the neck. The common carotid artery identified by its pulsations was felt emerging from above the upper pole of the tumour (Figure 1). The tumour was freely movable in all directions. It moved on swallowing, but the range of movement was less than usual with thyroid swellings and could have been due to contiguity of the tumour with

the larynx and trachea. The tumour had the size, shape and position of a large adenoma

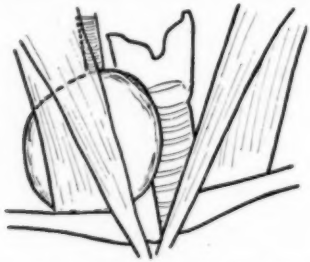

FIGURE I. Diagram depicting physical signs elicited in this case.

of the thyroid gland, and the only point weighing against the diagnosis was its small range of movement on swallowing. Operation was advised on the basis of a diagnosis of thyroid adenoma.

Operation 23/7/48 under local infiltration anaesthesia with omnopon premedication.

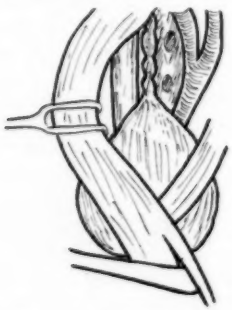

FIGURE II. Diagram depicting view of tumour at operation. The carotid vessels have been retracted from the internal jugular vein exposing the vagus nerve trunk and the transverse processes of the cervical vertebrae.

A Kocher's collar incision was made and the skin and platysma were dissected upwards. The deep fascia was divided along the anterior border of the right sternomastoid muscle and the sternomastoid muscle was retracted outwards. The tumour was exposed by blunt dissection. The omohyoid muscle crossed the tumour. The tumour was dull matt white. The upper pole of the tumour was exposed to display the superior thyroid vessels. A nodular cord the diameter of a slate pencil was seen to be attached to the upper pole of the tumour. This cord was firm and nodular and it did not pulsate. It emerged from between the internal jugular vein and the internal carotid artery (Figure II). Further dissection displayed the right lobe of the thyroid gland in contact with, but separate from, the tumour (Figure III).

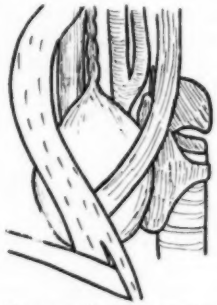

FIGURE III. Diagram showing relation of tumour to the lobe of thyroid gland as seen at operation.

It was now realised that the tumour was a large nerve sheath tumour of the vagus nerve. A longitudinal incision was made through the outer capsule of the tumour and the tumour was enucleated from within its capsule. There was an irritative cough at this stage, the pulse rate accelerated from 70 to 120 and the patient's voice became hoarse. The trunk of the vagus nerve was, however, seen to be intact running down the inner surface of the capsule of the tumour (Figure IV). The wound was closed.

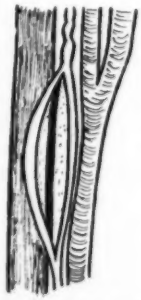

FIGURE IV. Diagram showing appearance of empty capsule after enucleation of tumour.

The patient made a good recovery from the operation. The pulse rate steadied to 70 in a few hours, but the voice remained hoarse. Indirect larnygoscopy showed loss of mobility of the right vocal cord.

Report on the histological appearances of the tumour: "The tumour is composed of broad bundles of fine wire-like fibrils staining red with eosin, and enclosed between

these fibrils are a few spindle cells with cells and nuclei elongated in the long axis

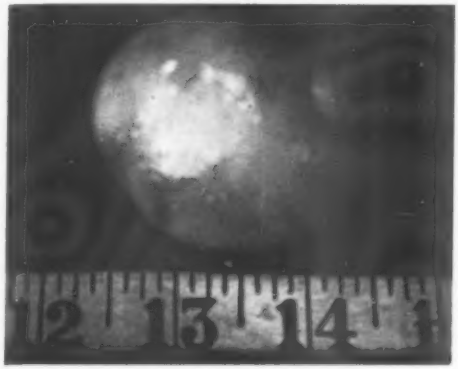

FIGURE V. Photograph of tumour.

of the bundles. These bundles of fibrils are separated by a loose reticulum in which angular cells with angular nuclei are irregularly disposed. There are no signs of mitotic division in the nuclei of the cells of the bundles or in the nuclei of the cells of the reticular tissue."

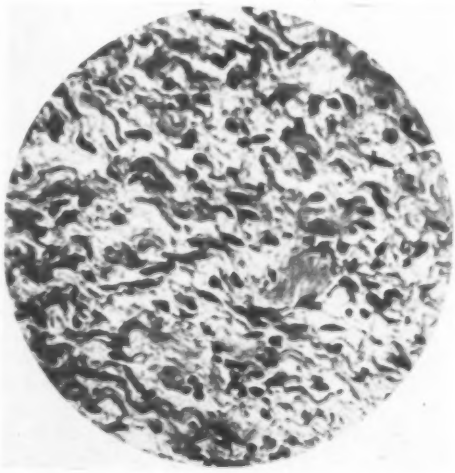

FIGURE VI. Photomicrograph of section of tumour. x 1000.

DISCUSSION.

The histological appearances are those of an undifferentiated nerve sheath tumour largely made up of Antoni's type B tissue. On these findings the tumour should be innocent and should be solitary. The vagus nerve trunk was, however, diffusely nodular from the presence of seedling nerve sheath tumours giving the appearances of the plexiform type of Von Recklinghausen's disease, and a small nodule was found in the left supra-orbital nerve at a special follow-up examination. If these findings be regarded as evidence for the patient being a "forme fruste" type of Von Recklinghausen's disease, the tumour should have shown the histological characteristics of an undifferentiated potentially malignant tumour.

In regard to diagnosis, the simulation by the tumour of a large adenoma of the thyroid is of interest. The movement on swallowing was of a range which might have been expected with a large, heavy thyroid adenoma and no doubt was entertained before operation in regard to this diagnosis.

With regard to treatment, at the time of operation, the decision to enucleate the tumour was made with a view of avoiding the loss of voice which would have followed an injury to the vagus nerve trunk. Unfortunately loss of voice did follow, and this could have been regarded with equanimity if the tumour were potentially malignant. It is, however, too big a price to pay for the removal of an innocent tumour. The question of the tumour being innocent or potentially malignant could not be decided even when all the facts of this case had been collated, and this is due to the present state of incomplete knowledge on this aspect of the subject.

I acknowledge with thanks the help received from Professor W. A. E. Karunaratne, Professor of Pathology, University of Ceylon, in the preparation of this paper.

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A CASE OF HYDATID OF THE LIVER PRESENTING SOME UNUSUAL FEATURES.

By Sir Henry Newland.

Adelaide.

(Accepted for publication, 27/1/49.)

THE X-ray film which I show displays a triangular shadow continuous with that of the liver and extending into the right side of the thorax as high as the third rib. This radiograph and three others form the text of this account of some unusual features of a case of hydatid of the liver.

The patient was a woman aged 53.

The salient points in her story were:—

1. That she was in her usual health until shortly before Christmas, 1947.
2. She first of all felt pain in both sides of the chest. She had periods of dry coughing without expectoration.
3. A little later attacks of pain and vomiting occurred. The pain passed below the right costal margin and jaundice appeared.

There was clinical evidence of great enlargement of the liver downwards, upwards and laterally, there being a marked bulge in the contour of the chest below the right axilla.

Slight jaundice was present, but no bile was detected in the urine. There was no rise of temperature during the period of observation prior to operation. To ascertain whether the large hydatid cyst in the liver was the cause of the dullness on percussion extending upwards from that of the liver to the level of the fourth rib, X-ray films were taken. The report of Dr. Hanson read: "There is an abnormal shadow at the right base largely caused by fluid in the pleural space and the heart is displaced towards the left side. The lung immediately above the fluid appears slightly abnormal, and it is likely therefore that the fluid is obscuring a morbid condition in the right lung." (Fig. I.)

In the light of what was later found at operation, this report is evidence that even X-ray methods may be at fault. As Dew has remarked in his book, "Hydatid Disease", "this type of case constitutes the chief source of radiological error."

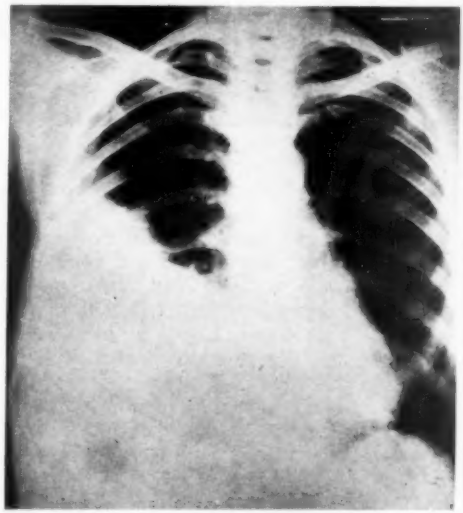

FIGURE I.

At operation, three inches of the right eighth rib were removed in the mid-axillary region. It had been designed to deepen the incision just below the reflexion of the costal pleura on to the diaphragm, but the pleural cavity was inadvertently opened. No fluid escaped. The opening was sutured and the incision deepened at a lower level. On incising the diaphragm, there was an immediate gush of hydatid fluid, daughter cysts and degenerated hydatid membrane. Examination revealed an aperture, with thin margins in the exposed surface of the liver easily admitting a finger. It was obvious that contents of the mother cyst in the liver had, prior to operation, escaped into the space between the liver and diaphragm and, acting as a fluid wedge, had pushed the lateral part of the right cupola of the muscle upwards to the level seen in the X-ray film.

The exit from the liver was incised in a lateral direction and sutured to the incision in the diaphragm. The hydatid contents within the fibrous capsule were then evacuated. This was not quite complete, as a few small daughter cysts and pieces of membrane escaped during the next few days through the drainage tube. Some weeks after the operation an X-ray film was taken to determine to what degree the cavity in the liver had contracted. For contrast purposes, lipiodol was injected. It is interesting to note that the oil, besides filling the cavity, entered the hepatic ducts and flowed through the common bile duct into the duodenum (Figure II).

FIGURE II.

FIGURE III.

Some time later, lipiodol was again injected; on this occasion resistance was felt to the flow. The oil was limited to the diminutive cavity in the liver, but no longer entered the ducts (Figure III).

Comment.

The course of events in this case would appear to have been as follows:—

1. A hitherto "silent" hydatid of the liver eroded the upper surface of the liver. Rupture of the mother cyst followed with the escape of some of its contents into the sub-diphragmatic space. The prompt elevation of the diaphragm and pleura would serve to explain the pain in the chest, the cough and the absence of expectoration at the onset of the illness.

2. The collapse of the mother cyst and the escape of ruptured daughter cysts into the cavity of the adventitious capsule permitted the entrance of hydatid material into patent bile ducts in the capsule. The passage along the ducts and common duct and the obstruction to the flow of bile arising therefrom would account for the attacks of biliary colic and jaundice which followed the initial chest symptoms.

3. Consequent on the operation, the diaphragm descended to its normal level, and the openings of bile ducts into the cavity in the liver became sealed in the course of its contraction.

My thanks are due to Drs. McCoy and Hanson for the radiological films and reports.

SOME CLINICAL ASPECTS OF UNILATERAL RENAL ECTOPIA.

A REPORT OF SEVEN CASES.

By

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(Accepted for publication, 17/6/49.)

FOUR examples of unilateral renal ectopia appear in the records of the Royal Prince Alfred Hospital, Sydney, over the past 38 years. Thompson and Pace (1937) give the clinical incidence of this condition as one case in every ten thousand patients examined at the Mayo Clinic. Its incidence at necropsy is given by these authors as one in twelve hundred. Thomas and Barton (1936) found 22 examples in 22,000 necropsies. According to the latter authors, the clinical incidence of ectopic kidney is 1 in every 547 urological examinations.

Unilateral renal ectopia is classified by Hinman (1938) as:

(*a*) Lumbar,
(*b*) Sacral,
(*c*) Sacro-iliac,
(*d*) Pelvic,

according to the level of fixation of the kidney. Macalpine (1936) adds that the organ may, in its ascent from the pelvis, overshoot its normal position and thus give rise to a condition of high lumbar ectopia. The organ has also been recorded lying in the pleural cavity, having passed through a congenital defect in the diaphragm.

The ectopic kidney exhibits anomalies of form, rotation and vascularisation. The renal pelvis is usually situated on the anterior aspect of the organ and is often of an abnormal shape, and unless this fact is remembered, errors in interpretation of pyelograms may follow. The aberrant blood supply or congenital bands and adhesions may render drainage from the ectopic organ inadequate.

The condition of the opposite kidney varies. In the series reported by Thompson and Pace, the opposite kidney was normal in 81 instances, absent in 8, and abnormal in 8. Nichols and Marr (1945) point out the possibility of mistaking a pelvic kidney for a tumour, and emphasise the danger of removing a solitary kidney situated in the pelvis erroneously diagnosed as a tumour.

An ectopic kidney is liable to all the pathological conditions that may affect the normally placed organ, but especially is it prone to hydronephrosis, infection and calculus formation due to inadequate drainage.

In the 97 patients reported by Thompson and Pace, many were asymptomatic, but 32.9% suffered from abdominal pain of recurrent nature. In the majority of cases the pain is of an atypical or bizarre type and its projection is, as a rule, peculiar. Rusche and Bray (1943) note that the symptoms are those of pelvic or abdominal conditions rather than renal. The ectopic organ may, if situated in the pelvis, obstruct the birth canal, but this is an unusual feature. When palpated per abdomen, it is often confused with other abdominal tumours and has to be differentiated therefrom. When felt per vaginam during gynaecological examinations, it may simulate other pelvic tumours.

The condition is therefore of interest to the urologist, general surgeon and gynaecologist and the following seven case reports illustrate some of its clinical features, diagnosis and management.

CASE 1.

The patient, a male aged 32, had first noticed the sudden onset of abdominal pain 12 months previously. The pain was sharp

and referred to the right iliac fossa and the right loin, and was accompanied by vomiting. It lasted about eight hours. Three weeks later he had suffered a similar attack of pain, during which appendicectomy had been performed. Following the operation, similar attacks of pain referred to the right iliac fossa and radiating from this point up towards the right costo-vertebral angle occurred. Haematuria had been noticed on one occasion one month prior to his present admission to hospital. For the past five years he had had to pass urine every half-hour during the day and twice at night.

FIGURE I. A retrograde pyelogram. The right renal pelvis is greatly dilated and lies below the brim of the bony pelvis. An opaque shadow lies in the line of the left ureter over the tip of the left transverse process of the third lumbar veterbra.

No abnormality was detected on clinical examination.

Examination disclosed that the patient's urine was turbid and that a trace of albumin was present. On microscopic examination of the urine 0 - 3 leucocytes and an occasional red blood cell per high power field were seen. Haemolytic staphylococcus aureus and haemolytic streptococci were cultured from the urine.

On cystoscopic examination, the bladder was found to be normal and the right ureter was catheterised without obstruction. Fifty c.c. of sodium iodide solution were injected into the right renal pelvis with reproduction of the pain of which the patient complained, and a retrograde pyelogram was taken. (see Figure I.)

An intravenous urogram was also obtained. (see Figure II.)

FIGURE II. An intravenous urogram. A round calculus lies in the right renal pelvis which lies to the right of the midline below the promontory of the sacrum. The left renal pelvis shows a moderate degree of hydronephrosis due to a calculus impacted in the ureter at the level of the upper border of the third lumbar vertebra.

Left uretero-lithotomy was performed.

Two months later the patient was in good health and had no recurrence of pain. A second intravenous urogram was obtained. (see Figure III.)

Ten months later he was re-admitted to hospital, having suffered five attacks of severe right lower abdominal pain since he had been seen last. Each attack lasted about eight hours, and on the last occasion had been accompanied by pyrexia.

Through a right lower paramedian incision a transperitoneal approach was made to the right kidney. A large vascular pedicle ran to its upper pole from the vicinity of the bifurcation of the aorta. The upper end of this vascular bundle briskly retracted out

of sight on its ligation and division. The ectopic kidney was gradually mobilised following ligation and division of aberrant vessels which entered from the periphery.

The patient's urine was clear and sterile on culture on his discharge from hospital.

The specimen is shown in Figure IV.

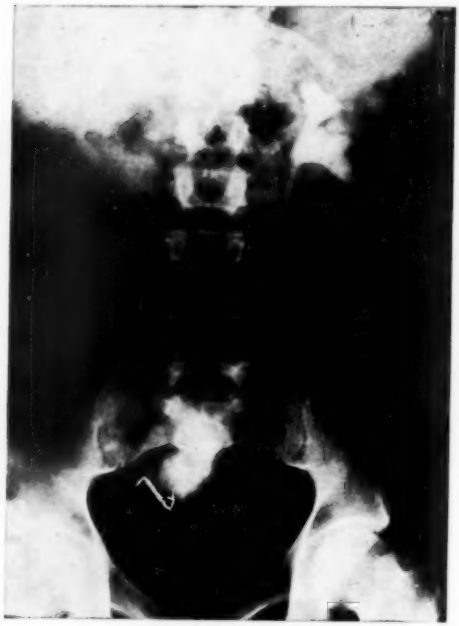

FIGURE III. An intravenous urogram, taken after left uretero-lithotomy. Note that the hydronephrosis of the left kidney has now resolved.

CASE 2.

An apparently healthy young woman aged 28 complained of pain in the right iliac fossa. The pain was described as a constant dull ache with an occasional exacerbation, during which the pain changed its character and became "knife-like". These symptoms had been noticed by the patient for many years. For the past four months she had also noticed pain in the back which was described as a continuous dull ache, referred to the right costo-vertebral angle. Frequency of micturition, 10 times at night and 10 times during the day, had been present for ten months.

Her appendix had been removed fourteen years before for symptoms of the same nature.

No abnormal constituents were present in the patient's urine. Cystoscopic examination was carried out with normal findings, and

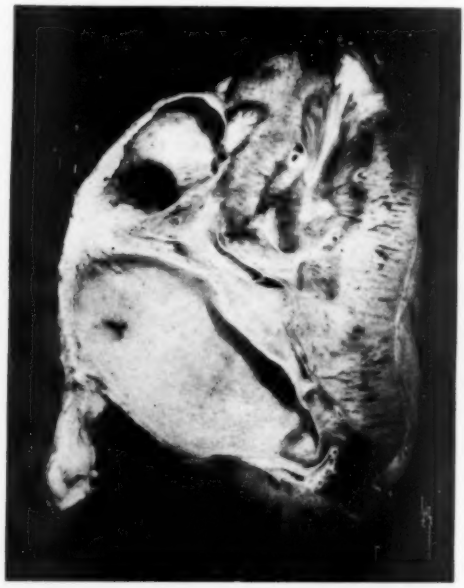

FIGURE IV. An abnormally shaped kidney measuring 9 x 4 x 6 cm. and of 120 gms. weight. The renal pelvis is thickened, dilated, and is situated on the anterior surface of the organ, the posterior aspect of which shows a deep indentation caused by the promontory of the sacrum. The main blood vessels enter the organ at its upper pole.

the injection of 7 c.c. of sodium iodide solution into the right renal pelvis brought on an attack of pain identical with that of which the patient complained. A retrograde pyelogram was obtained. (see Figure V.)

Through a right para-median sub-umbilical incision, a trans-peritoneal approach to the pelvic ectopic kidney was made, and nephrectomy performed without difficulty.

The ectopic organ measured 8.3 cm. in length and weighed 135 gms.. The renal pelvis was situated upon the anterior surface of a globular organ, microscopic examination of which disclosed very little abnormality.

CASE 3.

The patient, a female aged 47, had complained of pain in the right lower abdomen, loin and back for 20 years. The pain was described by the patient as a constant ache across the lower part of the lumbar spine

radiating from this location to the right hip-bone and down the anterior aspect of the right thigh.

Her past history disclosed that appendicectomy had been performed 20 years previously and three years later an exacerbation of the present pain had led to a gynaecological examination, following which a "plastic repair" had been carried out. The patient's symptoms were not relieved by this operation and on this account both ovaries and tubes

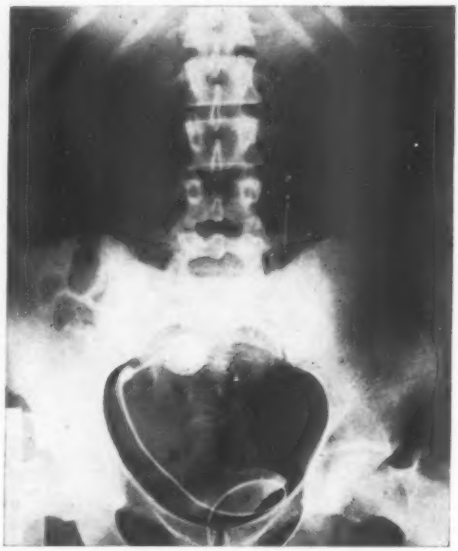

FIGURE V. A retrograde pyelogram which shows the catheter coiled up in the right renal pelvis which lies at the level of the brim of the bony pelvis just to the right of the midline.

had been removed eight years ago. Three years later, symptoms still being present, she had been given "injections" in the back for relief of the pain and an operation for "appendix adhesions" had been performed. The patient had six children and no miscarriages had occurred.

Abdominal examination disclosed a multi-scarred abdomen with a tender indefinite tumour palpable in the right iliac fossa.

Examination of the urine disclosed that albumen and sugar were absent, and on its microscopic examination an occasional leucocyte and red blood cell per high power field were seen.

At the cystoscopic examination the bladder wall was found to be normal and both ureters were catheterised without any obstruction. A bilateral retrograde pyelogram was obtained. (see Figure VI.)

FIGURE VI. A bilateral retrograde pyelogram. The right kidney lies over the right sacro-iliac joint just above the brim of the bony pelvis. The renal pelvis shows a moderate degree of hydronephrosis.

Through a Gibson's incision, an extra-peritoneal approach to the ectopic kidney was attempted, but adhesions resulting from previous operations on the appendix soon defeated this attempt and the surgical approach became an intraperitoneal one. The kidney was located lying on the right common iliac artery behind the caecum. Adhesions rendered removal of the organ difficult and haemorrhage from numerous aberrant blood vessels necessitated a blood transfusion in the operating theatre. The specimen is shown in Figure VII.

CASE 4.

The patient, a female aged 44, suffered from uterine fibroids which necessitated the operation of hysterectomy. During the course of this procedure the surgeon noticed the presence of a retro-peritoneal tumour high up on the posterior wall of the pelvis on the right side.

Pyelographic examination during the patient's convalescence showed the "tumour" to be an ectopic kidney normal in other respects. (see Figure VIII.)

FIGURE VII. The ectopic kidney measures 8 x 5 x 2 cm. and weighs 73 gms. It is ovoid in shape with an anterior renal pelvis and a deep groove on its posterior surface, the organ showing 130° angulation at this point. The groove indicates the impression made by the right common iliac vessels. Blood vessels can be seen entering the organ irregularly.

As no symptoms had been caused by the ectopic organ, interference on this account was not advised.

CASE 5.

The patient, a male aged 51, complained of pain in the left iliac fossa of two years' duration. The pain was described as a constant dull ache with occasional exacerbations in intensity which appeared to be brought on by exposure to heat or by exercise, and to be relieved by recumbency or by flexion of the left hip joint. He did not complain of any urinary symptoms, though he thought that four years previously he had passed some blood in his urine during the course of a "severe chill in the back."

Abdominal examination disclosed that the lower pole of the right kidney could be palpated and that deep palpatior in the left iliac fossa resulted in pain.

On microscopy of the patient's urine, 1 - 2 pus cells and 25 - 30 red blood cells per high power field were seen. The urine was sterile on culture.

A plain X-ray of the abdomen showed a rounded opacity lying over the left ala of the sacrum.

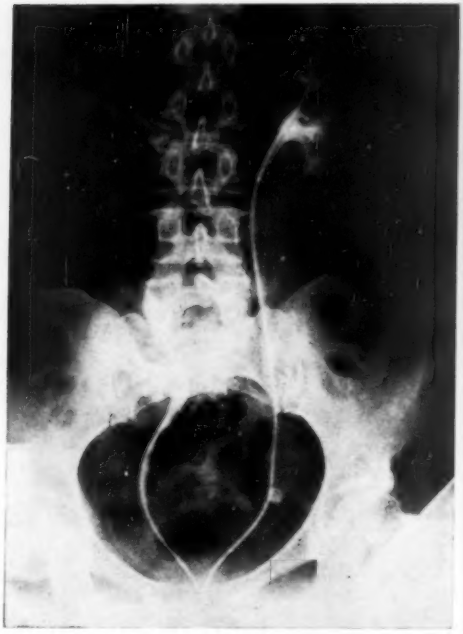

FIGURE VIII. A bilateral retrograde pyelogram. The right kidney lies over the fifth lumbar vertebra just to the right of the midline.

An intravenous urogram was obtained. (see Figure IX.)

A cystoscopic examination was performed and no abnormality was to be seen in the bladder. The left ureter was catheterised without obstruction and injection of 10 c.c. of opaque solution into the left renal pelvis, produced pain similar to, but not identical with, that complained of by the patient.

A left retrograde pyelogram was taken. (see Figure X.)

Left nephrectomy by the transperitoneal route was carried out through a left lower paramedian incision and an abnormally shaped kidney, whose pelvis contained a rounded calculus, was removed without difficulty.

The patient's convalescence was uneventful.

FIGURE IX. An intravenous urogram. The right kidney shadow is normal in outline, but the organ is malrotated. The left kidney and pelvic shadow is not visualised, but the pelvic section of the left ureter is well outlined. There is a rounded opacity over the left ala of the sacrum.

CASE 6.

The patient, a male aged 36, had, twelve years before being seen, suffered a severe attack of hypogastric pain followed by the passage of a blood clot per urethram one week later. He consulted his doctor and his trouble was diagnosed as an attack of "gravel". Following this incident, he had no further symptoms up till one month prior to being seen, when he had suffered a very severe attack of pain in the left hypochondrium with radiation of the pain to his left testicle. He did not complain of any urinary symptoms.

Clinical examination did not disclose any abnormality.

Microscopic examination of the patient's urine showed that red blood cells were present.

FIGURE X. A retrograde pyelogram. The left kidney pelvis, whose calyces are directed towards the midline, overlies the left ala of the sacrum. The opaque shadow previously seen has been obscured by the shadow of the left renal pelvis.

An intravenous urogram was obtained. (see Figure XI.)

As the ectopic organ showed good function and the patient was asymptomatic, operative interference was not advised.

CASE 7.

The patient, a female aged 56, complained of attacks of pain in the right loin for the past month. She had a similar type of pain over a period of years, but it had not been nearly so severe. The pain was located in the right loin, back and front, with radiation to the groin. The attacks lasted 4 to 5 hours at a time and attacks of pain had been experienced practically every day for the past month. The patient complained of nausea associated with the attacks, but she did not vomit.

There had been no urinary symptoms.

Appendicectomy and right oophorectomy had been performed 20 years before for pain of the same nature.

Clinical examination did not reveal any abnormality apart from the fact that slight tenderness was noted on palpating the right loin.

Examination of the patient's urine showed it to be clear, and no cells were seen on microscopy. It was sterile on culture.

FIGURE XI. An intravenous urogram. The right kidney is normal in position and shows good function, but the left organ lies at the level of the fourth and fifth lumbar vertebrae just to the left of the midline, and its calyces show a moderate degree of dilatation. A "cigar-shaped" opacity lies outside the line of the pelvic ureter on the right side.

A cystoscopic examination was performed and the bladder was shown to be normal. The right ureter was catheterised to 28 cm. and the injection of 9 c.c. of opaque solution into the right renal pelvis reproduced the patient's pain.

A retrograde pyelogram was taken. (see Figure XII.)

The patient did not desire an operation to be performed on the ectopic organ.

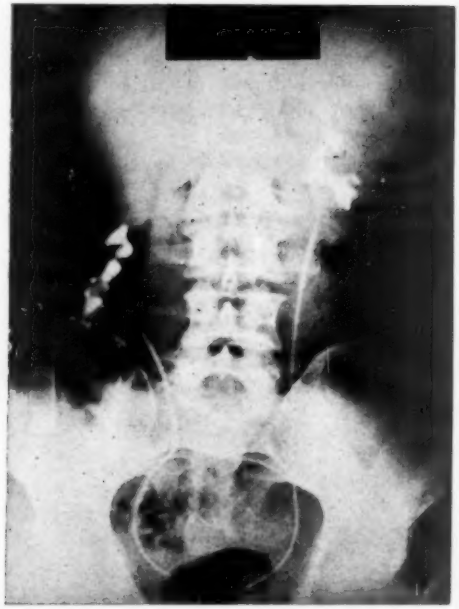

FIGURE XII. A retrograde pyelogram. The right renal pelvis lies at the level of the third and fourth lumbar vertebrae to the right of the midline. There is no evidence of urinary calculus or dilation of the calyces present.

SUMMARY.

1. Seven cases of unilateral renal ectopia are reported.
2. The condition is an uncommon one, but must be taken into consideration in the diagnosis of abdominal tumours and pain of obscure origin.
3. Calculus formation and hydronephrosis are commonly associated with renal ectopia. (Cases 1, 3, 5, and 6.)
4. Appendicitis is often diagnosed in error when the ectopic organ lies on the right side. (Cases 1, 2, 3, and 7.)
5. The ectopic kidney lying at the brim of the pelvis does not necessarily cause dystocia. (See Case 3.)
6. A transperitoneal approach is the route of choice for the surgical extirpation of the pelvic ectopic organ. (Cases 1, 2, and 5.)
7. Previous operations on the appendix render an extraperitoneal approach to the low lumbar organ technically difficult. (Case 3.)

8. The condition often does not produce symptoms and may be discovered in the course of clinical examinations for other complaints, or during the course of abdominal or pelvic operations. (Case 4.)

ACKNOWLEDGMENTS.

We are indebted to Mr. M. S. S. Earlam, of the Department of Urology, Royal Prince Alfred Hospital, Sydney, for permission to include the details of Cases 5 and 6 herein reported, and to the Department of Medical Artistry, The University of Sydney for the photography.

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INTERSTITIAL CELL TUMOURS OF THE TESTIS.

THE MALE SEX HORMONE.

By K. B. FRASER.

Brisbane.

(Accepted for publication, 10/1/49.)

SINCE the classical paper of Ancel and Bouin, written forty-four years ago, a great deal of experimental work has been done in an effort to establish the source of the male sex hormone.

Although some of the evidence is controversial, the concensus of opinion is that the interstitial cells of the testis, first described by Leydig in 1850, secrete the male sex hormone. Strong evidence in support of this contention is the fact that treatment of the testis with mild doses of X-rays results in atrophy of the seminiferous epithelium, while the interstitial cells remain unaffected and at the same time castration effects do not develop (Best & Taylor, 1945). Recently further proof of the role of the interstitial cells as the source of the male sex hormone has been presented by Hooker (1944). In an exhaustive study of the testes of stud bulls, whose ages were known with certainty, he showed that the great changes in androgen content after two years of age were accompanied in every case by changes of comparable degree in the numbers of, and vacuolation of, the interstitial cells: at the same time changes in the size and structure of the seminiferous tubules were in no way associated with changes in androgen level: neither could any changes in the character of the cells of Sertoli be associated with changes in the level of androgen.

It has been shown that a sudden and rapid rise in the androgen content in boys as measured by the excretion of 17 - Ketosteroids synchronises closely with the development of the gonads and the appearance of the secondary sex characteristics at puberty (Talbot and others, 1943).

Therefore, with the evidence at present available, it is reasonable to assume that the pubertal changes which occur in a normal boy within a fixed age period are in large measure, if not entirely, due to the increased activity which normally occurs in his interstitial cells over this period.

The Interstitial Cells of the Testis and Their Behaviour.

The interstitial cells first appear in the human embryo of 19.5 mm., probably as a result of transformation of mesenchymal cells (Maximow, 1947); in the latter half of gestation they decrease relatively in number; during infancy and early childhood they remain relatively scanty and do not show any marked increase until the approach of puberty. They lie in the testicular stroma in the angular spaces between the seminiferous tubules; they are large, irregularly pohyhedral cells with small round nuclei and abundant acidophilic cytoplasm. In the fresh state the cytoplasm is filled with highly refractile granules of neutral fat and lipoids; numerous brownish granules are also present, and sometimes characteristic, heavily staining, rod-shaped crystalloids known as Reincke's crystals.

Interstitial cell tumours have been reported from time to time in animals. Innes (1942), in an elaborate and detailed study of a large number of testicular neoplasms in animals, discovered fifteen such growths, fourteen being in dogs and one in a calf: of these, two cases only were malignant.

Experimentally it has been found possible to produce nodular new growths of interstitial cells in mice by weekly injections of oestrogen (Bonser, 1940, 1942); in several cases metastases, both blood-borne and lymph-borne, occurred.

In man, simple hyperplasia of the interstitial cells is by no means uncommon; it has been shown to occur in chronic cachectic conditions, chronic alcoholism, acute illnesses, particularly pneumonia, in imperfectly descended testes (Figure I) and in pseudohermaphroditism, as well as in atrophy, due to local inflammatory causes. In all these cases there is associated tubular atrophy. Simple hyperplasia always involves the whole testis diffusely, the cells never being

localised in, and limited to, a distinct nodule. In some instances the hyperplasia is so marked that the already existing tubular atrophy is aggravated. In this event the interstitial cells may come to occupy more and more of the substance of the testis at the expense of the degenerating tubules; careful histological examination, however, should always distinguish such cases from those of neoplastic origin.

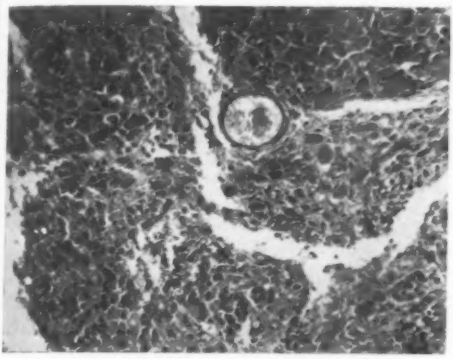

FIGURE I. Hyperplasia of the interstitial cells in an imperfectly descended testis. x 190.

In contradistinction to the relative frequency of hyperplasia, new growths of the interstitial cells of the testis in man are extremely rare.

Historical Review of Interstitial Cell Tumours.

Cairns (1926), in his Hunterian Lecture on neoplasms of the testis, delivered in 1926, in which he critically analysed ninety-five tumours of the testis occurring at the London Hospital, does not include them in his classification; he does, however, mention Sacchi's case referred to below.

Wyndham (1947), discussing testicular tumours which occurred in the Australian Army during the war, remarks that he has never seen an interstitial cell neoplasm.

The earliest recorded case is that reported by Sacchi, of Genoa, in 1895; Parkes Weber (1929), who knew of this case in 1902, later came across a copy of Sacchi's paper in the Library of the Royal College of Surgeons; the photos show a boy of nine years with a luxuriant growth of beard and the stature and general appearance of a grown man: symptoms had commenced at the age of five and a half years and excision of the tumour was followed by gradual retrogression of the physical signs of precocity.

The first authentic adult case in the literature is that described by Chevassu in 1906; it occurred in a man twenty-seven years old who developed a rapidly growing tumour in an imperfectly descended testis lying in the inguinal canal.

The second case in childhood, again in a boy of nine years, was recorded by Rowlands and Nicholson in the Guys Hospital Reports of 1929.

The third case occurring in children, to which reference can be found in the literature, was reported by Stewart, Bell and Roehlke from the Department of Pathology, University of Minnesota, in 1936.

Jemerin (1937) made the most complete, and at the same time the most critical, review of interstitial cell hyperplasia and neoplasia that had been presented up to that time. He considered that a number of previously reported cases were either obviously spurious or gave insufficient histological details for the diagnosis of neoplasm to be reasonably established; in addition, marked hyperplasia had on occasion been erroniously referred to as of neoplastic origin.

After an exhaustive analysis, some of which is open to question, he came to the conclusion that only seven definite cases and four other possible cases, among those reported, had been true interstitial cell tumours.

Huffman (1941) recorded a case of testicular tumour in a boy of six years, which he concluded was an interstitial cell adenoma; the photo of this boy shows genitalia only slightly larger than normal, while at the same time there is a marked degree of gynaecomastia, an associated sign which has been absent in all other proved cases of Leydig cell tumour in children.

Warren and Olshausen (1943) went to great lengths to uncover the records of any cases that could reasonably be considered as interstitial cell tumours. They found that all proved cases but two had occurred under

the age of forty-five years: one of the two patients over forty-five years was included among the three proved malignant cases in the series. They were unable to unearth any additional cases in children; they seem, however, to have missed Somerford's case in a boy of eleven years which had appeared in 1941, and their paper was already in the press when Werner (1942) presented the sixth recorded case in childhood.

Another definite malignant tumour in an adult was reported in 1943 (Sharnoff), and next year Nation, Edmondson and Hammack gave details of three new adult cases, one of which was malignant; they came to the conclusion that up to that stage twenty-six acceptable cases of interstitial cell tumour had been reported, twenty in adults and six in children under twelve years of age; they asserted that there were only five malignant cases in the series and drew attention to the fact that all tumours in children had been benign.

Shortly afterwards another definite case, again in an adult, was unearthed in Iran (Neeve and Marsh, 1944).

Broughton (1948) refers to what is probably the largest series of testicular tumours yet collected; these were dealt with at the Urologic Service of the Walter Reid Hospital, Washington, D.C., during the Second World War. From approximately ten million American servicemen almost one thousand patients (0.01%) with neoplasms of the testis were concentrated at this hospital up to May, 1946.

Actually nine hundred and twenty-two testicular tumours in this series were collected at, and critically reviewed by, the Army Institute of Pathology at Washington (Friedman and Moore, 1947); of these, only nine (1%) were found to be interstitial cell tumours; 96% were seminoma, embryonal carcinoma, teratoma or teratocarcinoma, and the remaining 3% were rare or unclassifiable varieties. In 1946 Broughton received a personal communication from Lloyd Lewis of Washington containing a review of two hundred and fifty cases of tumour of the testis, two of which were stated to be interstitial cell tumour.

The most recent tumour to which reference can be found was benign in type and occurred in a man fifty-three years old whose maldescended testis was removed during a hernia operation (Price, 1948). This, together with the present case, brings the number of proved interstitial cell tumours, detailed accounts of which have been found in the literature, to forty; seven of these have occurred in children under twelve years of age.

Case Report.

D.H., the younger of a family of two boys, was born on 21st January, 1944; he developed normally until he was two years old, when his mother noticed that his penis appeared slightly larger than normal for his age. Any increase of size, however, at this stage, was very gradual.

In March, 1948, two months after his fourth birthday, his parents became alarmed at the rapid increase in the size of his penis and sought medical advice.

They had noticed also that he developed erections much more frequently than his elder brother; the evidence regarding libido was conflicting; however, there were indications to suggest that he had begun to take an increased interest in young girls with whom he played, although only one incident had occurred to actually alarm his parents. There had never been any ejaculations.

At this time he weighed 22.7 kilogrammes (50 lbs.), which was above the upper normal limit for his age; his muscular development was greater than normal. His height was 116.8 cms. (46 inches) and his general conformation like that of a boy of at least ten years old. His facial expression was stolid, but his mental development was, if anything, above average. His voice was low-pitched and his speech slow, with good articulation.

His penis was obviously much larger than normal: it measured 7.6 cms. (3 inches) in length and 8.6 cms. (3⅜ inches) in circumference; there was a suspicion of commencing "downy" pubic hair, but no hair on his chest or in the axillae.

The right testis was normal in size; the left testis felt rather bigger than the right, but there was no difference in general contour or in sensation between the two; the actual difference in size between the two testes was very slight at this stage, but was particularly noted, as, in the writer's ex-

perience, difference in the size of the right and left testis is hardly ever seen in young children apart from some obvious cause such as hydrocele, traumatic haematocele or atrophy following mumps orchitis, etc. Both spermatic cords seemed normal. No abdominal mass could be felt. His eyesight was good, and the fundi were normal; blood pressure was 92 mm.-50 mm. Hg. His skin was healthy with no suspicion of acne; urine examination showed nothing abnormal; apart from a moderate degree of knock-knee and slight calcaneo-valgus, his physical examination revealed nothing further of note (Figure II.)

X-ray investigation of the lower ends of the forearm bones and of the foot disclosed a stage of bone development normally seen at six and a half years, indicating that his "bone age" was two years in advance of his chronological age. A skiagram of the skull revealed a normal pituitary fossa and no sign of any intracranial calcification; an intravenous pyelogram showed a good concentration of dye in each renal pelvis and no evidence of any displacement of either kidney.

FIGURE II. D.H.: aged four and a half years. The photo was taken three weeks after operation and the pubic hair was only just commencing to reappear.

The Aschheim-Zondek test was negative; facilities were not available to carry out a 17-Ketosteroid estimation.

In view of the absence of any findings to suggest an adrenal cortical tumour or any cerebral lesion to account for his condition, it was decided to wait and keep him under observation.

On 11th May, two months later, there seemed to be no appreciable change in his condition. A month later, however, on 15th June, it was found that his penis was 8.9 cms. long and 9.5 cms. in circumference, an increase of 1.3 cms. in length and 1 cm. in circumference, as compared with the measurements three months previously; there was a suggestion that the left testis had increased in size; pubic hair was more marked and darker in colour and coarser than when first seen.

It was felt at this stage that the sexual precocity might be due to a small tumour in the left testis and that, although the diagnosis was by no means certain, the definite clinical evidence of progressing sexual precocity warranted removal of this organ.

The position was explained to the parents, and on 14th July he was admitted to hospital for left orchidectomy.

At this stage it was noted that the left testis had definitely increased in size in the last month, but even now a casual examination of the scrotum would have shown nothing abnormal.

At operation the vas and vessels were tied off and cut as high up as possible and the testis and distal part of the cord removed.

The tunica was normal; there was a very small amount of clear fluid in the vaginal sac.

The testis measured 2.2 cms. x 1.7 cms. x 1.25 cms.; it was normal in shape, consistency, contour and colour; in fact, apart from the moderate difference in size between the two testes, there was nothing to indicate a tumour even at this stage (Figure III).

FIGURE III. The left testis and epididymis before section, indicating the very moderate increase in size.

On section a spherical brown mass was found lying more or less centrally placed in what appeared to be normal testicular tissue; the tumour seemed definitely circumscribed (Figure IV). The epididymis, vas and vessels were slightly larger than usual for the age, but otherwise looked normal.

Dr. G. C. Taylor's report on the specimen read:—

"Transverse section of the enlarged testis revealed a small, round, rusty-brown tumour about 0.9 cm. in diameter in the centre of the body of the testis.

"It appeared circumscribed and encapsulated.

"On microscopial section the tumour consisted of a mass of eosinophilic cells with small vesicular nuclei and cytoplasm having a foamy appearance.

"The cells in places were arranged in cords and columns and, judging by the number of capillaries, appeared to be richly supplied with blood.

"No mitotic figures could be seen;

"No interstitial cells were found elsewhere among the testicular tubules.

"Not having seen this type of newgrowth before and realising the tumour was quite unlike the usual tumours of the testis, viz., seminoma or teratoma, I referred the section to Professor Canny, who had no hesitation in diagnosing the condition as an interstitial cell tumour of the testis."

Report by Professor A. J. Canny:—

"The material available for examination was part of a testis and the corresponding epididymis which had been fixed and bisected in a sagittal plane. The vertical and anteroposterior axes of the testis measured 2.2 cms. and 1.7 cms. respectively. Immediately in front of the epididymis and reaching to within 3 mms. of the upper pole of the testis was a pale red-brown area, sharply circumscribed but not obviously encapsulated, almost circular in outline and measuring

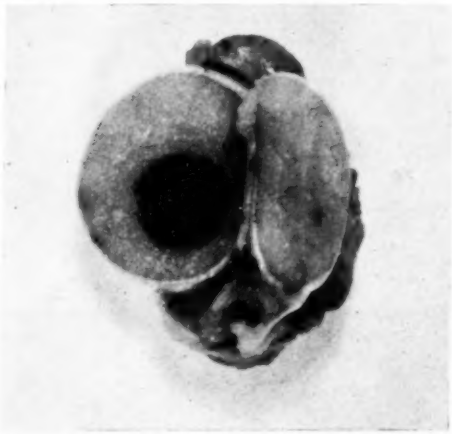

FIGURE IV. The testis after sagittal section, showing the distinct colouration and circumscribed nature of the tumour. The tumour tissue in the second half of the testis had been removed for examination.

9 mms. in diameter. The rest of the testicular tissue and the epididymis appeared normal. As all the tissue was inadvertently embedded in paraffin, examination of frozen sections was precluded, and this report must be regarded as incomplete in so far as it

does not include any positive reference to the lipoid content of the tissue examined.

"The minute anatomy of the testis beyond the limits of the circumscribed area of pigmentation, the rete testis and the epididymis appeared to be within normal limits for a boy of about five years of age, although there had been some distortion of the structure of the seminiferous epithelium during fixation. At least it can be said that there was no evidence of atrophy of the seminiferous tubules, nor was there any evidence of maturation to the stage of spermatozoon production. Beyond the limits of the pigmented area no Leydig cells were found.

"The area which to the naked eye was distinguished by its difference in colour from the surrounding testicular tissue was a compact mass of polyhedral cells intersected by some fine strands of fibrocellular connective tissue and traversed by a moderately rich system of blood sinuses and capillaries. The component cells had a maximum diameter of approximately 25 u. This mass of cells was not encapsulated, but was sharply demarcated at its margins; the neighbouring testicular structure did not appear to be compressed. Nuclear structure was slightly variable, but the most commonly occurring type of nucleus was circular, bounded by a thin but distinct nuclear membrane and measuring about 8 u. in diameter. The chromatin was arranged in a moderately coarse mesh formed of fine strands. Most nuclei contained a single, clearly defined circular nucleolus. Two nucleoli were seen in a few nuclei. The cytoplasm was in some few cells homogeneous and uniformly eosinophilic, but in the majority was finely vacuolated. A few cells contained small numbers of granules which were slightly basophilic, but even in unstained sections no lipochrome granules could be seen. In the absence of direct evidence it could only be tentatively assumed that the cytoplasmic vacuolation was indicative of the presence of lipoids.

"Because of the absence of lipochrome pigment it was thought that the colour of the tissue might have been due to local haemosiderosis. This was disproved by demonstrating the lack of chemically detectable iron within the pigmented zone. Perhaps the rich vascularity was alone responsible for the red-brown hue observed on naked-eye examination. The question arises whether the colour seen in other proliferations of Leydig cells, whether hyperplastic or neoplastic, is not due to some extent at least to a rich vascularity rather than to the presence of lipochrome granules. On the other hand, the lipochrome pigment may in some instances be diffusely spread throughout the cytoplasm of the Leydig cells and so contribute to the pigmentation of tissue in which discrete granules cannot be seen.

"The relationships of these cells can be assessed on the following bases:

(1) They have developed in a situation which in due course would have been the site of the pubertal growth of Leydig cells.

(2) They resemble Leydig cells in form and in size.

(3) Their general cytoplasmic characters as seen in paraffin-embedded tissue are similar to those of Leydig cells.

(4) In bulk they constitute a tissue with a hue resembling that often seen in tumours of interstitial cells of the testis.

(5) This colour is not due to the deposition of iron containing haematogenous pigment.

(6) There is a lack of discrete granules of lipochrome pigment, but many normal or hyperplastic Leydig cells do not contain these granules.

(7) The structure of their nuclei is almost identical with that found in normal Leydig cells.

(8) The proliferation of these cells was associated with hormonal effects similar to those usually attributed to the interstitial cells of the testis.

"One feels therefore that the probability that these cells are derivatives of Leydig cells is very great and that the mere absence of lipochrome granules is not an adequate reason for invoking an heterotopic development of adrenal or any other endocrine tissue to explain the observed association of structural and functional disturbances.

"This solitary focal accumulation of cells, which in their nuclear and cytoplasmic structure and in their biological effects bore so close a resemblance to Leydig cells, one will accept on these grounds as a proliferation of the interstitial cells of the testis. Within its confines was a rare seminiferous tubule essentially normal in structure (Figures V and VI).

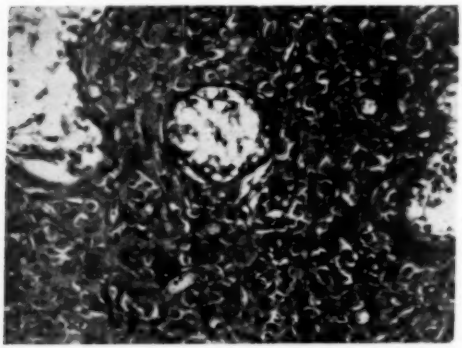

FIGURE V. A section of the tumour demonstrating the compact mass of cells, the circumscribed border, the absence of a definite capsule, and the inclusion of a normal seminiferous tubule. x 190.

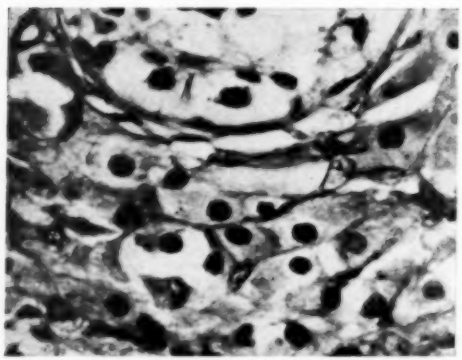

FIGURE VI. A high-power view of a portion of the tumour tissue displayed in Figure V, showing the circular nuclei in the finely vacuolated cells. The lower border of the seminiferous tubule can be seen in the upper third of the microscopic field. x 750.

"This incorporation of tubules within the agglomeration of polyhydral cells indicates either that the proliferative process which led to the development of these cells was, within a limited area, multicentric in its incidence and that fusion of the separate foci of cellular proliferation had already been completed when the testis was removed; that the process was extending centrifugally to call forth the formation of interstitial cells from the undifferentiated mesenchyme or that the progeny of the interstitial cells initially called into being were endowed with slight locally invasive properties.

"It would be profitless to indulge in metaphysical discussion as to whether this localised proliferation of Leydig-like cells should be called hyperplastic or neoplastic. Suffice it to say that one is prepared to accept the definition of a neoplasm given by R. A. Willis — 'An abnormal mass of tissue, the growth of which exceeds and is uncoordinated with that of the normal tissues and persists in the same excessive manner after cessation of the stimuli which evoked the change.' The proliferation of Leydig-like cells just described conforms to the terms of this definition except for the lack of evidence relating to the biological character of persistence or to the nature and duration of the stimulus which evoked the proliferation. In the absence of this evidence it is only possible to say that the circumscribed, even if multifocal, nature of the proliferation and its lack of co-ordination with normal growth, which is made evident by the abnormal hormonal effects which it caused, are more in keeping with a neoplastic than a hyperplastic process as these terms are commonly employed.

"In so far as the malignancy or benignancy of the process is concerned, one can only say that the uniformity of the structure of the proliferating cells and their close structural resemblance to Leydig cells must be weighed against the lack of encapsulation and the incorporation of seminiferous tubules within the mass of functionally abnormal cells. The criteria of malignancy in interstitial cell tumours of the testis have not yet been established. In the absence of any evidence that new growths of this group with essentially normal structure of their constituent cells are capable of metastasising, one would suggest that this growth is probably endowed at most with limited local invasiveness."

On examination of the patient in August, 1948, six weeks after operation, it was noted that the pubic hair had reappeared where it had been shaved, but the bulk of hair present had not increased. The penis

was 7.9 cms. long and 8.2 cms. in circumference; in other words, it had decreased 1 cm. in length and 1.3 cms. in circumference since the operation.

In October, 1948, just three months after the operation, he came up for review again. His relatives volunteered the information that no erections had been seen since shortly after the operation, although a careful watch had been kept; his reactions when in the company of other children were now quite normal.

The pubic hair was still present, but was softer and somewhat thinner. His penis was now 7.3 cms. in length and 7.9 cms. in circumference, a decrease of 1.6 cms. in length and 1.6 cms. in circumference since the operation.

It is interesting to note that the decrease in the size of the penis in the three months after operative removal of the testis actually was greater than the increase in size in the four months prior to operation.

Two months later again, in December, 1948, the penis had not altered in size, but the pubic hair had practically disappeared, only a few sparse hairs remaining.

DISCUSSION.

The diagnosis on clinical and pathological grounds seems well established in this particular case.

The red-brown colour of the tumour is a characteristic feature of these neoplasms and is very well exemplified in the coloured plate accompanying Bonser and Hawksley's (1943) article. The histopathological picture leaves no doubt as to the nature of the cells. The sharp line of demarcation between the tumour and the surrounding tubules, the difficulty experienced in finding any isolated collections of interstitial cells apart from the tumour itself and the normal character of the tubules are all features which point to tumour formation as distinct from simple hyperplasia.

The presence of macrogenitosomia which retrogressed after unilateral orchidectomy is strong, confirmatory evidence that the clinical manifestations were, in fact, due to the tumour in the left testis.

The absence of Reincke's crystals is of no import, as other observers (Snellman, 1939) have failed repeatedly to find them in proved cases of tumour.

A positive Aschheim - Zondek test, the diagnostic value of which has been so thoroughly investigated (Twombly and others, 1942) in teratoma of the testis, is not to be expected in an interstitial cell tumour. There is no evidence to suppose that a tumour of interstitial cells is ever associated with the production of prolan such as occurs in the more common types of testicular new growths. The absence of gynaecomastia is further evidence — if such were needed — that the precocity was in no sense due to adrenal hyperplasia and negatives the possibility that the tumour cells were composed of atopic adreno-cortical tissue.

The main features of the seven cases of interstitial cell tumour in children, of which I have been able to obtain detailed information, are recorded in Table 1.

The similarity between the various cases in children is worthy of comment: the notable exception is the case of Huffman; it was the only one in which gynaecomastia was in evidence, although admittedly this sign was present in two adult cases.

It is reasonable to assume that the presence of gynaecomastia in an interstitial cell tumour is due to the elaboration of oestrogen by the testis directly or indirectly, and it would seem that gynaecomastia would only appear when the androgen produced by the tumour was not of sufficient quantity to nullify the effects of any excess oestrogen.

It is admitted that the exhibition of testosterone benzoate has been known to cause development of mammary tissue in immature male and female rats (Seyle and others, 1936).

However, it is significant that in Huffman's case not only is the clinical picture at variance with the other cases, but the macroscopical and histopathological features do not conform to type, and this tumour may well have been one of atopic adrenal cortical tissue.

While abnormal genital development is a feature of all cases in children, sex

changes in adults have been limited to the development of gynaecomastia in a few isolated instances; again, while a certain proportion of tumours in adults have been malignant, all cases so far reported in children have been benign in nature; however, in view of the fact that metastases have taken up to four and a half years to make their appearance, a careful and prolonged follow up should be made in every instance.

TABLE 1.

Case.	Date.	Age at onset of symptoms.	Age at operation.	Precocious Male Sexual Changes.	Excessive size for age.	Gynaecomastia.	Colour of Tumour.	Benign or Malignant.	Retrogression of precocious sexual changes
Sacchi.	1895.	5½ years.	9 years.	Yes.	Yes.	No.	?	Benign.	Yes.
Rowlands & Nicholson.	1929.	6 years.	9 years.	Yes.	Yes.	No.	"Brownish".	Benign.	No.
Stewart Bell & Roehlke.	1936.	4 years.	5 years.	Yes.	Yes.	No.	"Dark Brownish".	Benign.	Yes.
Huffman.	1941.	4 years.	6 years.	Slight.	Slight.	Yes.	"Pale Grey-Yellow".	Benign.	No.
Somerford.	1941.	5 years.	11 years.	Yes.	Yes.	No.	"Pinkish Brown".	Benign.	No.
Werner.	1942.	5½ years.	6½ years.	Yes.	Yes.	No.	"Yellowish Grey".	Benign.	Yes.
Fraser.	1948.	4 years.	4½ years.	Yes.	Yes.	No.	"Red Brown".	Benign.	Yes.

The remarkable similarity in the ages at which symptoms have first appeared in children is very striking. This period (four years - six years) is not associated with any demonstrable changes in normal interstitial cells, but some endocrine factor yet undiscovered may play a part in the development of tumour formation during this age period.

The degree of retrogression of sexual changes after operation has not followed any definite pattern; a careful review of the seven cases in children, however, lends colour to the opinion that more rapid and more complete retrogression will occur in those cases which are diagnosed and operated upon soon after the commencement of symptoms.

SUMMARY.

The part played by the interstitial (Leydig) cells of the testicular stroma in the elaboration of the male sex hormone is discussed.

Reference is made to the histological characteristics and the normal life history of these cells as well as to the occurrence of spontaneous and artificially produced tumours of interstitial cells in animals.

Attention is directed on the one hand to the relative frequency of hyperplasia of the interstitial cells, and on the other hand to the rarity of tumour formation, in man. The necessity for careful histological examination is stressed before a final diagnosis of neoplasm can be established. A brief historical review of forty cases of proved interstitial cell tumour reported in the literature is presented. Special reference is made to the seven cases which have occurred in children.

A case of interstitial cell tumour in a boy of four years is reported. The histopathology of the tumour and the facts on which the diagnosis was established are discussed and the retrogression of clinical signs of sexual precocity after removal of the tumour is noted.

CONCLUSIONS.

Interstitial cell tumour is a very rare type of new growth of the testis. While more likely to occur in adults, in which a small proportion of cases are malignant, it may occur in children in whom all cases so far

reported have been benign. When occurring in children it is most likely to manifest itself first between the ages of four and six years.

The presence of such a tumour in a child is always accompanied by increased growth and signs of sexual precocity.

The earlier the diagnosis is established and the tumour removed, the more complete will be the return to normality of the patient.

ACKNOWLEDGMENTS.

Thanks are expressed to Dr. A. W. St. Ledger, who first referred the case D.H. to me, and Dr. G. C. Taylor, who made the original pathological examination. It is desired particularly to thank Professor A. J. Canny for his very thorough review of the pathology of the tumour, and grateful acknowledgment is made for the work done by Dr. J. Inglis, Mr. G. E. Thomson, and Mr. A. Stark in the preparation of the microscopical sections and the photomicrographs.

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Note: Review of the patient D.H. in June, 1949, six months after the last recorded examination, disclosed that there had been a further reduction of 0.6 cms. in length and 0.3 cms. in circumference of the penis.

SOME POINTS IN THE DIAGNOSIS OF LABYRINTHINE VERTIGO AND A SURVEY OF METHODS OF TREATMENT, MEDICAL AND SURGICAL.

By Douglas G. Carruthers.

Sydney.

(Read at the 22nd Annual General Meeting, June, 1949.)

(Accepted for publication, 31/3/49.)

TO be the subject of severe and recurrent vertigo is to dwell in bondage. The attacks when they occur may be quite devastating. Not even the strongest will is able to resist the disorientation of equilibrium which takes place. Having survived, and then again being smitten down, the victim remains robbed of poise and confidence, dreading the occasion when his malady may again assert itself.

There are lesser degrees of this disturbing ailment and these cases may often be assuaged with simple measures. Some of the more severe types are such as to exercise all the ingenuity of the physician in efforts to determine the site and nature of the laesion, and it is these cases, too, which have caused the surgeon to ponder the possibility of destruction of the offending organ or the severance of its afferent nerve trunks. Some operations have aimed more conservatively to provide for drainage of the membranous otic labyrinth or more remotely to influence the blood vessels through the automatic vaso-motor nerve mechanism. For success with either medical measures or surgical operations it is desirable that the cause, or modus operandi of perhaps numerous causes, shall be understood. That some disturbance of fluid tension within the labyrinthine spaces is the essential factor in most, if not all, cases, is an impressive theory. The occurrence of such a disturbance gained strong support with the post-mortem demonstration of "endolabyrinthine distension" by Hallpike and Cairns in 1938. Within this conception a reaction to allergy, to vaso-motor disorder, or through faulty water metabolism, can all be explained. Whether the various remedies which are proffered are each or all truly effective, in a condition prone to spontaneous remission or even lasting recovery, cannot be truly proven with any small series of cases. To contemplate destructive and possibly hazardous surgery calls for conviction that the laesion is unilateral and for ingenuity to demonstrate with certainty the side involved, and to exclude potentially progressive disease of the opposite ear.

Since rational treatment can only be based upon accurate diagnosis, it is perhaps permissible briefly to outline some comparatively recent work which has been recorded, notably by British experimenters and clinicians. Not very many years ago at a meeting of physicians and otologists which I attended, the remark was passed that very often by the time the specialist sees these cases the acute symptoms have passed and there is little or nothing to show for it. The work of Fitzgerald, Hallpike, Cawthorn, Dix, Hood and others make it quite evident that to the observant eye and enquiring mind quite a lot does remain which will serve to demonstrate the side and precise location of the laesion.

When there occurs an associated disturbance of equilibration and of hearing, the lesion must be in either the eighth nerve or in the inner ear. That lesions of the brain stem may be quite extensive and cause but little disturbance of hearing, I demonstrated in 1935. While many patients will report attacks of vertigo which are associated with tinnitus and increasing deafness, quite often symptoms referable to the hearing are absent so that conjecture arises immediately as to where is the seat of the trouble and in some of these cases the lesion may be cerebellar or elsewhere. Modern hearing tests give greater clarity to the picture in these cases and will often reveal that the hearing is, in fact, affected and may demonstrate clearly the site of disorder. Audiometric study may demonstrate some degree of hearing loss at either end, or throughout the tone scale. In over 70 per cent. of cases the hearing tests

reveal either unilateral involvement or a marked selection of one side. A fascinating development of audiometry is in the application of the Loudness Balance (L.B.) Test, in which Recruitment (Fowler, 1936) in the relative perception by the poorer ear appears to take place as the test tone is made progressively louder so that it may frequently be observed that while the threshold of perception of the two ears may be widely separated, yet at intensities of loudness well above threshold of the poorer ear the test note may seem to be equally well heard in either ear. In conduction deafness, such as that of the middle ear disease, the laesion apparently acts as an equal attenuator for all intensities so that recruitment does not occur. In certain forms of inner ear nerve deafness it is believed that as loudness is increased, the more strongly actuated hair cells will be stimulated sufficiently to saturate the cochlear fibres or cells of the cochlear nuclei so that the cerebral cortex will receive the same number of impulses per second from both ears and will then perceive the tone as coming equally into each ear. The phenomenon is thus believed to be pathognomic of nerve deafness. In a recent paper by Dix, Hallpike and Hood (1948), dealing with this phenomenon, it appears to be clearly demonstrated, however, that the test may be applied to differentiate a laesion of the eighth nerve from a true inner ear lesion such as that which gives rise to Meniere's Symptom Complex. Of thirty cases with unilateral deafness due to Meniere's disease the loudness recruitment phenomenon was able to be demonstrated in all. There were eleven cases of neurofibroma of the eighth nerve and nine of other space occupying laesion of the cerebello-pontine angle. In fourteen of these twenty cases a complete absence of recruitment was found, while in the remaining six only slight recruitment was evident. Here, then, is a form of nerve deafness in which recruitment is not able to be demonstrated, and it is suggested that in the application of this loudness balance test we now have a means at our disposal to make clear the distinction between end-organ deafness and vertigo, and that arising from a disturbance of the nerve trunk.

Some further analysis of the caloric labyrinthine reactions also appears likely to be of value in the elucidation of the nature and site of vertiginous laesions. For some time it has been known that a tonic effect is exerted upon the vertibulo-ocular nuclei in the brain stem from the temporal lobes of the brain, and it has been demonstrated that in laesions of one temporal lobe what has been called "directional preponderance" of caloric nystagmus to the side of the lesion may be observed. That is to say, caloric-induced nystagmus is of longer duration when in the direction of the side of the laesion than that directed to the opposite side. In practice this will be that the stimulus produced by cold water will be of longer duration from the opposite ear than that arising from cold excitation of the ear of the same side as the lesion, while the reaction from hot water will be more enduring after excitation of the ipsolateral ear; that is, of course, with the patient lying supine. Cawthorn, Fitzgerald and Hallpike (1942) studied the development of directional preponderance of induced caloric nystagmus in a series of cases in which unilateral labyrinthine destruction was produced surgically for the relief of vertigo. In every instance there was for a considerable time afterwards a marked directional preponderance of the induced nystagmus to the side of the intact ear. This they interpreted as evidence of a continuing tonic influence from the unoperated ear arising probably from the utricle and in turn they assumed that the finding of directional preponderance clinically might be taken to indicate the presence of a paralysed utricle of the side opposite to that of the directional preponderance. Paresis of the semi-circular canal or of the eighth nerve trunk by contrast gives rise to diminished or absent responses from the particular side after both hot and cold stimuli. It is evident that the occurrence of several types of variation from the normal pattern of caloric responses may be expected to provide for considerable differentiation of aetiological factors.

Phillips (1949) in a recent paper has outlined the process of diagnosis of the eighth nerve tumour very concisely. He particularly stresses the finding of unilateral absence of caloric reactions, disturbance of sensation via the fifth nerve and increased C.S.F. pressure and a raised protein content as of diagnostic significance. Add to these observations the analytical auditory and vestibular tests outlined above, and it should be possible with accuracy to prove or exclude

the existence of an intra-cranial laesion. To-day one is concerned only with the exclusion of such a lesion so that subsequent remarks concerning treatment of vertigo will bear only upon the true labyrinthine disorders.

To discuss treatment in any dogmatic fashion, especially irreversible surgical methods, at this stage when methods of analysis are only just coming to be revealed, and when these tests and clinical and histological examinations are only beginning to make it clear that refinements of diagnosis and of prognosis are practicable, would be to stullify our purpose by trying perhaps to narrow down our conclusions when the time is obviously not yet ripe to do so.

I hope briefly to outline the most promising methods of medical and surgical treatment and to make small, and I trust appropriate, comment from the point of view of practical experience.

I think the evidence is sufficiently established to indicate convincingly that the symptoms result from variations in intra-labyrinthine tension. I doubt, though, whether gross endolabyrinthine distension such as Hallpike and Cairns demonstrated might be found in every instance. The symptoms are frequently too transient for such a condition as that. I am more inclined to believe that within the theory of varying labyrinthine tension there is a place for allergic oedema, faulty water metabolism, vascular spasm or other forms of narrowing, disturbance of osmotic tension due to electrolytic inbalance (sodium-potassium) and possibly other changes such as faulty resorption form the saccus endolymphaticus.

Atkinson (1943) claimed that by a skin test using minute quantities of histamine diphosphate intradermally, it was possible to demonstrate that some cases were allergic and to distinguish these from non-allergic cases. Where a positive result was obtained in the form of a well-marked urticarial wheal with prominent pseupodia he recommended the search for possible allergens especially in the diet, and attempts at desensitisation with increasing doses of histamine. The non-sensitive group he regarded as prone to a vasospasm and he used nicotinic acid up to 300-400 mg. daily, at first intramuscularly, and thence by mouth as a maintenance measure for considerable periods of time. Atkinson has continued to write enthusiastically of his methods. Not all agree with the ready division into allergic and non-allergic cases. In my experience the use of nicotinic acid, not necessarily by injection at all, but given orally in doses of 25 to 50 mg. 3 or 4 times daily, is one of the most useful remedies so far devised.

Mygind and Dida Dedering (1932, 1938) in a series of papers have suggested that the symptoms result from a disorder of water metabolism, with the result that there is some tendency to fluid retention. These two observers have claimed results from restriction of fluid intake and measures to promote elimination. There is some evidence that the diuretic action of the pituitary may be of some significance in this regard and appropriate stimulation of this function may be assisted with ovarian hormone or testosterone.

Furstenberg, Lashmet and Lathrop (1934) considered that there was some fault in the electrolyte balance, and especially sodium, rather than accumulation of water alone. These writers claimed a number of cases to be rapidly relieved after strict limitation of salt intake, at times combined with displacement of sodium from the tissues by giving ammonium in the form of the chloride in capsules of grs. 7½ (0.5 gramme), six after each meal thrice daily. This medication is usually well tolerated, especially if given intermittently, three or four days on, and three or four days off. Talbott and Brown reported improvement in all of a series of 48 cases with the administration of 6 to 10 gm. of potassium chloride daily and low sodium chloride intake.

One has described a variety of methods which might be confusing to the practitioner in search of what to do were it not for the fact that each and all of the measures has some application to a common conception of what happens to produce the Meniere's syndrome, namely, a variation of fluid tension. In a condition often self-limited, with perhaps long intervals between the attacks, it is difficult to be certain that each of the methods described is always effective, yet practical experience leaves one convinced that a combination of the various measures

does bring speedy relief to many patients in whom the symptoms were obstinate. One's usual practice after a diagnosis has been reached is to order total avoidance of salt in cooking and at the table, half the usual fluid intake, and nicotinic acid 50 mg. four times daily by mouth on the empty stomach. The patient is advised beforehand of the hot flushing caused by nicotinic acid so that the treatment is not feared or abandoned. One has not found it necessary to give the drug by injection, nor to give quite such large doses as employed by Atkinson. Patients are advised to persevere with the full treatment for several weeks or perhaps months. Rarely has it been necessary to prescribe ammonium or potassium chloride. For the not very frequent cases where one is called to treat a case of persisting vertigo, the administration of histamine intravenously has been quite effective. One has followed the direction given by Lillie Horton and Thornell (1944). Histamine diphosphate, 2.75 mg. in 250 c.c. of 0.8% potassium chloride solution is given intravenously at a rate of 50-60 drops per minute. It has seemed advisable in all instances to give attention to general health and to the psychological environment. Be it of direct influence or not, focal sepsis should be eliminated — teeth, tonsils, sinuses, etc., should not be allowed to remain in a diseased condition. Many of these patients are definitely neurasthenic and need to be made to rest. Smoking should be reduced or abandoned. Endocrine disorders should be sought and appropriately corrected.

With but rare exceptions, medical measures as outlined above have been sufficiently effective so that surgical measures have had only occasionally to be contemplated.

The evolution of surgical measures has been most interesting. The first procedure to achieve some success was drainage of the saccus endolymphaticus through the mastoid as advocated by Portmann (1927). The operation apparently was successful in some cases and might well have been expected to be so in the light of the now established fact of endolabyrinthine distension, which it has been suggested is partly due to defective absorption of endolymph into the perisaccular reticular tissues. The great difficulty in locating the saccus in many instances and the obvious impossibility of maintaining drainage from such a small site into an operation scar are against the selection of this method. Sepsis must have been a problem when the operation was first performed. To-day that hazard would be avoidable with antibiotics. The operation may yet become of value and may be performed with greater accuracy following the development of well-illuminated operating microscopes. It has an appeal in that hearing may be undisturbed by such a procedure.

With the development of intracranial surgery and in view of the relative frequency of eighth nerve tumours, operative technique to approach and excise these lesions was a relatively early development. Since a similarity of symptoms and occasional obscurity of diagnosis made surgical exploration of the cerebellopontine angle region a justifiable procedure, consideration was soon given by the neuro-surgeon, notably W. E. Dandy (1928) and K. G. McKenzie (1941), to the practicability of giving relief in the Meniere syndrome by division of the vestibular division of the eighth nerve. Dandy reported that from a half to four-fifths of the cochlear nerve might be divided without loss of hearing. While the neuro-surgeon might claim that eighth nerve section involves but little risk, nevertheless the otologist has continued in search of a more peripheral site of attack. A better understanding of the pathological basis of the trouble, greater accuracy in diagnosis, a further interest in labyrinthine surgery subsequent to the development of fenestration for otosclerosis, and the ability to control sepsis with antibiotics, have each contributed to arouse the present interest in the problem. As far back as 1911, S. J. Jenkins had written both of labyrinthine fenestration for deafness, and of a surgical approach to the labyrinth for the relief of vertigo. Throughout the intervening years the otologist has considered labyrinthine operations only as a measure to stem advancing infection. The modern fenestration operation has become practicable largely because we are able to control infection. With the development of a successful technique for this operation it was natural that the lessons learned should be applied to the surgical treatment of vertigo. Cawthorn (1943), after exposure of the external semi-circular canal, makes a window opening into the lumen of the canal and removes or destroys the membranous

canal by maceration. An operating microscope is desirable for this procedure.. Degeneration of the labyrinthine organ is usually caused by this procedure and there is often a total loss of hearing, although the cochlea is not always destroyed in this manner. Some surgeons have endeavoured to assure widespread degeneration of the end organs by electro-coagulation within the labyrinthine vestibule through the fenestra in the external canal. This operation is effective and provided the disease is confined to one ear, the loss of hearing likely to be caused may reasonably be faced. Full-range audiometric tests and differential caloric tests as earlier described should first be carried out and the findings analysed carefully. Then if the case be resistant to medical measures, this is a procedure which may be undertaken with but little risk. Since the facial nerve is clearly visible, it is safe from injury.

Wright (1944) described a process of injection of alcohol through the oval window, using a needle which was pushed in through the tympanic membrane in the appropriate direction and then was guided by feeling to enter the vestibule. Facial nerve paralysis resulted in one of his earliest cases. There has thus been some reluctance to risk the hazards of this semi-blind procedure. One is caused to think, however, of the very beautiful exposure of the oval window region to be obtained through the approach devised by O. Pepper (1946) for his operation of trans-tympanic fenestration. Through this approach the oval window might readily be punctured under clear vision and with the facial nerve in view. Recently Lempert (1948) has described a trans-tympanic approach to the site of the oval and round windows. This surgeon claims that complete cochlovestibular degeneration can be achieved after removal of the stapes, breaking the oval and round windows into one and needling the membranous structures of the vestibule.

Most would prefer that surgical procedures should aim at conservation of hearing rather than destroy it. All otologists will have seen cases of intractible vertigo in which the hearing is not greatly damaged, or it may be that the patient is past middle age and there is some deafness in both ears. In either instance there will be reluctance to contemplate a procedure which will cause additional loss of hearing. Those who perform these destructive operations plead that the deafness is usually unilateral, or that the affected ear perceives in such a distorted fashion that its value is negligible. There is evidence that in cases with long remissions the hearing may improve. Lillie and Horton (1944) demonstrated considerable hearing gains in their cases which responded to histamine treatment. If there is useful hearing, or if it is likely that improvement in hearing might result from decompressing procedures, then we must seek for a procedure which will leave the hearing undamaged or may even help to restore it. The neuro-surgeons may well lay claim to the choice of the eighth nerve section in that this procedure often leaves the hearing undisturbed. Obviously we have not yet devised the perfect procedure. Sympathectomy has been considered from time to time by various authors. Acting on the assumption that a disturbance of blood supply through the internal auditory artery might be responsible for the symptoms, and that this should be able to be influenced by division of the sympathetic nerve supply, E. R. G. Passe and J. S. Seymour (1948) of London have described an operative procedure which includes peri-arterial division of the sympathetic nerve supply by stripping the vertebral artery or complete division of that vessel, section of the afferent fibres from T1 and T2 to the stellate ganglion and finally excision of the ganglion itself. Of twelve cases reported by the authors, all were relieved of vertigo. Tinnitus was lessened in most, and considerable improvement in hearing resulted in ten of the twelve cases. Horner's Syndrome apparently was not lasting, nor was it disturbing to the patient. No serious consequences have been recorded, although the possibility of secondary cerebellar thrombosis should the vessels be diseased is discussed.

Recently when in New York one was privileged to be shown cases under treatment by Professor E. P. Fowler, who was using streptomycin for its selective action upon the vestibular function. All otologists are probably aware of the fact that after administration of streptomycin for any period in excess of three weeks vertigo is prone to be complained of, and if the substance is further employed, the caloric labyrinthine responses soon tend to become

suppressed and finally are lost. The cochlear function is but rarely harmed. As a treatment for intractible labyrinthine vertigo, streptomycin is likely to be found quite useful. Unfortunately we have no way of limiting its action to one side only.

SUMMARY AND CONCLUSIONS.

A clearer picture of what occurs to produce labyrinthine vertigo is becoming revealed. A disturbance of fluid tension does seem to occur in many instances. Visible distension of the endolabyrinth has been observed by several who have studied post-mortem material. In less severe and transient cases the changes may be intercellular or even intracellular. A neuritis of the vestibular nerve or ganglionitis may occur in some instances.

A number of medical measures which aim by various and often diverse methods to reduce fluid tension within the labyrinth are effective in the majority of cases and their action may be rationally explained within the theory of variable fluid tension.

Methods which provide for differentiation between eighth nerve laesions and vestibular disorder are described together with finer auditory and equilibratory tests which help further to localise the site of inner ear disturbance.

The factors which have influenced the surgical approach to the treatment of vertigo are outlined. The intra-cranial division to the eighth nerve is considered in comparison with an aural approach to surgical drainage or destruction of the vestibular tissues. The desirability and practicability of conservation of hearing is discussed.

The hope that a drug may be forthcoming which may selectively suppress or destroy the equilibratory mechanism while the hearing is unharmed is engendered with the observation that streptomycin has such a selective action.

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THE INDICATIONS FOR INDUCING FUSION AT THE ANKLE JOINT BY OPERATION, WITH DESCRIPTION OF TWO SUCCESSFUL TECHNIQUES.

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(Read at the 22nd Annual General Meeting, June, 1949.)
(Accepted for publication, 31/3/49.)

THE use of this somewhat unwieldy title arises from the fact that, although one of the procedures which I hope to describe to you is a fusing operation, it is not in the strict sense an arthrodesis. The title therefore had to be suitably qualified.

The Indications For Fusion.

The need to restore to the fullest possible degree the depleted function of a joint and the part of which it is a component, provides the fundamental indication for a bone fusion operation. In other words, the successful issue of any such procedure rests, not upon the inducing of bony fusion between the articular surfaces, but the degree to which the fused articulation meets the functional requirements of the limb, or part.

The varied circumstances which may so depreciate the ankle joint function as to call for arthrodesis may be classified as follows:

1. *Injuries.*—Fractures, whether simple or compound and with or without dislocation, which involve the distal articular tibial surfaces, may disturb function in two ways:

(a) They may so disarrange the relation of the ankle components as to destroy the mechanical efficiency of the joint so that it can no longer operate competently as a stable, smooth-working hinge between the foot and the leg. We have, for example, injuries which result in medial or lateral displacement of the foot, producing diastasis, or a foot tilted in response to an abnormal deflection of the transverse axis of the joint.

(b) Injury may so disturb the bearing surfaces as to make it impossible for the anti-friction mechanism to neutralize the greatly increased friction, resulting in abnormal wear and tear, or, as it is generally described, "traumatic osteo-arthritis". Examples are found in certain lipping fractures of the tibia and in those in which the distal end of the bone in crushed and comminuted.

Injury may effect the function of the joint indirectly, by a disturbance of the muscle control. The muscles may have undergone intrinsic damage, or, their nerve supply may have been destroyed. It would be competent for injury acting in this way to provide an indication for fusing the ankle.

2. *Disease.*—Disease may impair the efficiency of the ankle in two ways:

(a) Directly, by destroying the articular surfaces to induce a fibrous, or, to use Thomas' classic description, "an unsound ankylosis". The pain and swelling, which usually results from this state of affairs, may require arthrodesis for its relief. This effect is encountered not frequently and then usually as the result of infected compound injuries about the joint.

Primary pyogenic infection of the ankle is rare in my experience, as also is infection by the tubercle bacillus. I propose to deal with the question of fusion as it relates to the last named condition in a separate section of this paper.

Osteo-arthritis of varying degree, or, as I prefer to describe it, age change, due to depreciation of the anti-friction mechanism of a joint, may develop to a crippling level, as the result of injury, whilst in some cases it is induced by some adverse factor which may not be easy to determine. It is competent in any event to produce such disability as may call for fusion.

(b) Indirectly.—Some diseases and disabilities of the nervous system, such as anterior poliomyelitis and certain disturbances of the upper motor neurone system, may bring about such instability and loss of control at the ankle and foot as to call for fusion of the ankle, with or without similar measures for the foot.

With respect to the flail foot and ankle, it

is not rare, in the presence of a fused foot of long standing, to find such a degree of instability at the ankle as impairs the result of the tarsal fusion and calls for fixation of the ankle joint.

In certain cases of severe pyramidal tract disturbance, associated with a high degree of spasticity, I have fused the ankle joint, after having reduced the foot to a completely flaccid state by extirpating portion of every tendon linking the foot with the leg, with very gratifying results.

3. *Congenital Defects.*—The serious and rare incapacity resulting from the congenital absence of the fibula should be greatly minimised by arthrodesis.

THE REQUIREMENTS FOR SUCCESSFUL ARTHRODESIS.

These are:

1. Complete extirpation of the articular cartilage, fibrous tissue, or other material, to expose raw bone over the whole extent of the surfaces to be co-apted. This requirement must be met by an approach to the joint which will permit ready and adequate exposure of the whole of the surfaces of its several components.

2. Accurate, close-fitting, and continuously maintained apposition of the prepared surfaces. This is particularly important in respect of the ankle where rawing of the bone ends widens the ankle mortice, leaving a gap between the malleoli and talus. This effect is enhanced if, as not frequently happens, patches of sclerosed bone are encountered on the articulating surfaces. These call for deep gapping of the surfaces before normal raw bone is exposed.

3. Careful selection of such a relationship between the components of the former joint as will ensure the best function when fusion is complete.

Whilst this requirement is a basic one in respect of every fusion operation, it has a very particular application to the ankle. The angles at which the talus is set to the leg will determine those which the foot will bear to the axis of the weight thrust through the leg, and the margin between the correct and incorrect angles is a very narrow one. There is no room for error, particularly when tarsal fusion accompanies, or has preceded fixation of the ankle. The surgeon should aim to secure the foot at 10° plantar flexion with the leg, without any trace of tilt or deviation of the foot towards inversion or eversion.

These two essentials can be met by using what may be described as a malleable graft, as opposed to one of the fixed type. If the rawed surfaces are brought into the closest possible association, by careful preparation and by packing between them finely particled cancellous and cortical bone, all gaps are obliterated, and the relationship of the various components can be set accurately in a way which is impossible with a fixed graft, implanted firmly into the surfaces of the tibia and talus. I will describe later a very simple contrivance, the use of which ensures that the foot will be set subsequently at the desired angles with the leg, whilst it is maintained there with plaster.

4. The final requirement calls for the undisturbed maintenance of this relationship until fusion is complete. That is, until the bone is organized mechanically, as revealed finally by the stress lines of the trabeculae. It is the presence of these, and not the confused shadow which is sometimes interpreted as an indication of complete bony ankylosis, which indicates the final resolution of the bone.

This requirement demands a lengthy period of fixation, followed by very carefully graduated weight-bearing and a selection of the type and degree of strain best fitted to encourage the laying down of the correct lines of stress. Living bone is elastic under all conditions, but in the formative stage it is also malleable. Its response to undue strain is exactly similar to that of soft tissue. Pain and swelling are the clinical manifestations of the changes set up by over-stress, and must be looked upon as the warning signals during this critical stage of final resolution. The malleability of healing bone provides a factor competent to upset the most careful placement, if stress is taken too heavily and too soon.

THE OPERATION.

The operation to be described was devised in 1942 to meet the requirements of a particular problem. I hasten to disclaim any desire to seek precedence in originating the technique; I think it is highly likely that

very many surgeons before me, when confronted with the same set of circumstances, have dealt with them essentially as I did, and that many more in the future, blissfully unaware of what I have written, will decide, under the same circumstances, upon the procedure which I have adopted.

In 1944, I saw a young vigorous soldier, who some two years previously had suffered a severe abduction fracture at the ankle region. It left him with marked diastasis, with lateral shift and tilt of the talus. There was a wide gap between the medial malleolus and the talus. His ankle was painful and insecure. It was clear that his requirements in relation to function could be met best by an arthrodesis.

With an Esmark's tourniquet applied to the leg, a vertical incision about eight inches in length was made in the line of the crest of the tibia, crossing the ankle joint just medial to the line of the tendon of tibialis anticus, curving very slightly medially, to end opposite the neck of the talus. After fixation of the skin towels, the incision was carried straight down to the bone, just medial to the tibialis anticus, and continued distally to traverse and open the ankle joint at the level of the medial aspect of the medial malleolus at its junction with the tibia.

With a sharp periosteum elevator entered at the last named point, all the soft structures in front of the ankle joint and lower end of the tibia, as well as their attachments to the talus, were lifted sub-periostially to expose completely the front of the ankle joint. Suitable retraction of the detached tissues, and manoeuvring of the foot, amplified the exposure. A thin, flat, sharp osteotome, 1¼" wide, was then laid along the vertical axis of the tibia, exactly in line with the lateral face of the medial malleolus at its junction with the tibia (Figure IA.c).

It was driven in firmly and carefully, to separate cleanly the medial malleolus together with the buttress of tibial cortex which flares out from the shaft at the lower extremity of the medial aspect of the bone, to seat the malleolus. Care was taken not to divide the periosteum on the back of the tibia or to damage the tendon of tibialis posticus.

The large flake of bone with the attached process was then swung backwards on the periosteal hinge, giving complete access to the ankle joint from the medial side, as well as to the inner articular surface of the talus and the corresponding malleolar articular face.

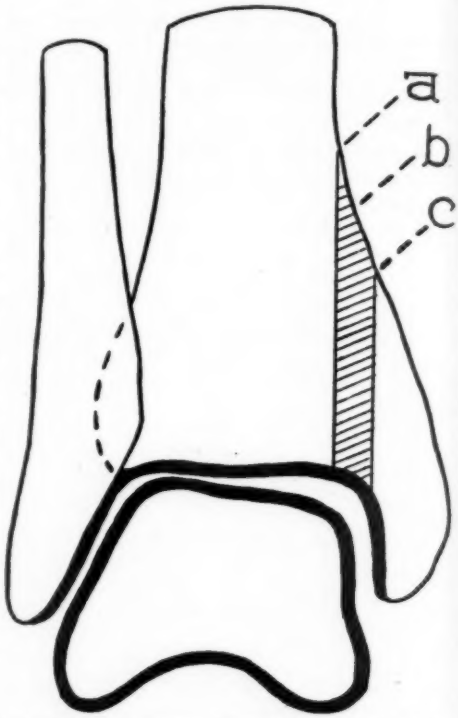

FIGURE I A. Drawing illustrating the type of deformity for which the operation was originally designed. Note the tilt and lateral shift of the talus.
(a) Line of the second incision.
(b) The slice of bone to be removed.
(c) The line of the first incision.

A second incision was now made in the bone, exactly parallel to the first, but in a plane lateral to it (Figure IA.a). The object of this was to remove a slice of bone of a thickness sufficient to enable the talus and malleolus to be brought together closely at the completion of the operation (Figure IB).

It will be appreciated that since diastasis was present, the thickness of this slice was determined by the width of the gap resulting from the lateral taloid shift, in addition to the increment establishel by denuding the contiguous surfaces of talus and malleoli of articular cartilage.

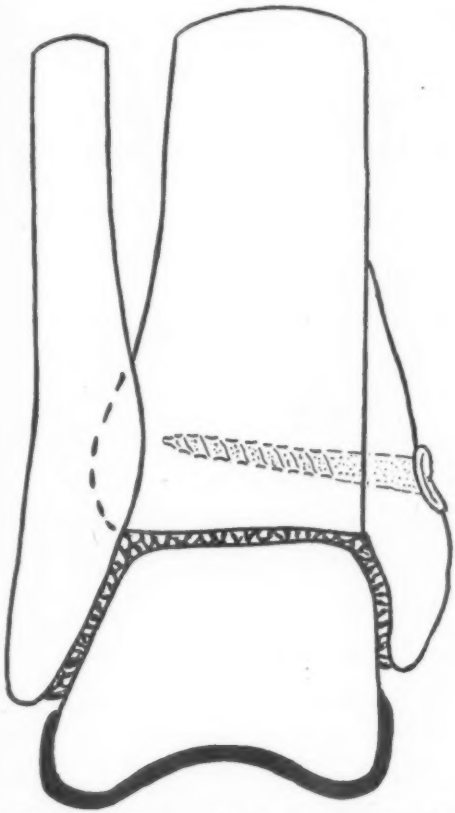

FIGURE I B. The particles of bone secured from the removed slice have been packed between all denuded joint surfaces and the tibiomalleolar flap swung back against the tibial shaft and held with a screw. Note the closure of the original gap.

A further result of this manoeuvre was of course to reduce the abnormal and unsightly width of the ankle region, and restore its symmetry.

With thin, sharp gouges, suitably curved and of various widths, the articular surfaces were carefully and methodically denuded of cartilage. The slice of bone was finely particled and packed carefully between all rawed surfaces. It was found to be ample for this requirement. The bone flap was swung back into position, taking care to see that the particle bestrewn surfaces of the talus and medial malleolus were brought into close contact.

The lateral malleolus was then exposed by turning back the necessary flaps through a small semi-circular incision. A $\frac{3}{16}$" drill was passed through each malleolus into the substance of the talus, to house two bone dowels, which had been cut and shaped from the crest of the tibia. Care was taken when making the drill-holes to see that the foot was maintained in a position of 10° plantar flexion at the ankle level. This determination was helped by the use of a goniometer of my own design, which is fitted with a flange which rests beneath the foot.

The line of incision in the bone was closed by approximating the periosteum. The skin was sutured and the limb from mid thigh to the toes was secured in a plaster cast, applied over the dressings. The knee was held in slight flexion. The after treatment followed the lines to be described subsequently.

The patient was reviewed on the 21/3/49. He walked without the slightest trace of a limp, could run and play tennis, and lead a

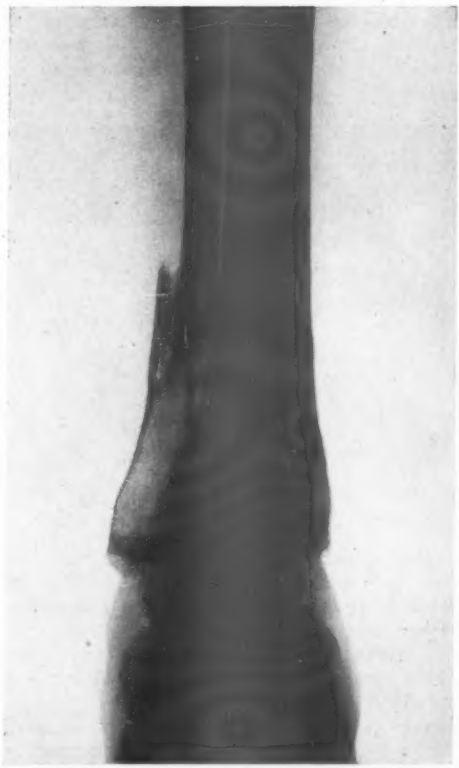

FIGURE II. Antero-posterior skiagrams of the original patient M.P. taken five years after operation. Ankylosis fully established. The outline of the bone dowels passed through the malleoli can be made out.

very active business life. On two occasions only had his limb given him any trouble — once, after playing tennis the whole of one Saturday afternoon and the whole of the following Sunday, he had suffered from cramps in the calf muscles. The same complication had followed a period when, due to some heavy business calls, he had worked continuously on his feet, without rest or sleep, for about forty hours.

The foot was found by goniometer estimation to be fixed exactly in 10° plantar flexion and he bore his weight squarely on his foot in relation to the horizontal plane (Figures II and III).

I mention these findings to indicate the highly satisfactory degree of function which can be obtained by arthrodesis of the joint.

The practicability of the technique and the immediate result so pleased me that I have adopted the fundamental steps as a standard method when I wish to fuse an ankle joint. I have made some modifications however.

FIGURE III. Lateral view of patient M.P.

The advantage of being able to mould the foot and set it accurately at a determined angle in relation to the leg at the conclusion of the operation, establishes the merits of the malleable type of graft at a level far above those associated with the grafts of the fixed type as recommended by Watson-Jones, or the use of bone dowels. I have therefore discarded the dowelling procedure as described above.

It is a simple matter to hold the replaced bone flap securely in position against the tibia, by using one Vitallium screw, and, when occasion demands it, I use this procedure (Figure IV). Usually, however, the

FIGURE IV. Illustrating the use of the screw as described. Ankylosis well on the way to final establishment. An indication only of the bone incision can be discerned. There was originally slight diastasis at this ankle.

suture of the periosteum is adequate for this purpose, and the position can be held further secure by moulding the plaster whilst it is setting.

On a few occasions I have considered that the circumstances of the problem could best be met by clearing the joint from the lateral side, after throwing back the lateral malleolus. I much prefer, however, the medical approach.

Not every ankle which needs to be fused is the seat of diastasis and it is not often that there is available the generous slice of bone which I encountered at the first operation. Nevertheless, the rawing of the taloid and malleolar surfaces does leave a gap which needs the removal of a slice of bone for its elimination. If the volume of the slice is not sufficient to provide enough bone to pack the prepared surfaces adequately, the necessary amount can be gouged away from the lower end of the tibial shaft, and I would remind you that cortical bone, provided it is finely morselled, provides as effective a graft as does cancellous material.

The chief, and I think, the most useful addition to the technique which I have been able to devise is the contrivances already mentioned. This takes the form of a splint, the purpose of which is to allow the final setting between the leg and the foot to be

estimated accurately and maintained without difficulty.

It is cut beforehand from a perfectly flat piece of sixteen gauge aluminium. It is in the form of an inverted "T". The stem is 1½" wide and of a length to reach from the upper calf to the level of the under-surface of the heel. It joins the cross piece slightly obliquely and at a point well behind its centre. The obliquity is carefully calculated and marked out on the aluminium, so that, when the splint is cut, the leading edge of the stem will make an angle of 100° with the longer arm of the cross piece. The length and breadth of the latter equal the corresponding dimensions of the foot. The centre of its junction with the stem corresponds with the junction of the long axis of the leg projected down in the centre line of the lateral malleolus, with the foot (Figure Va).

When the cross piece is swung to one side through an angle of 90° in relation to the stem, it forms a sole-plate, tilted in relation to the stem at an angle of 10° plantar flexion (Figure Vb). If the splint is cut and angled accurately, it will be found that, with the sole-plate in position, the whole foot will be supported and controlled, so that the three weight-bearing points are set squarely and with equal pressure on a perfectly flat, firm surface. The horizontal axis of the foot and the required angle of plantar flexion are secured and controlled (Figure Vc).

Under actual operative conditions, the steps are as follows:

A thick dressing is placed over the front of the ankle and dorsum of the foot. It must not encroach upon the sole. It is held in position by a single layer of thin dressmakers' wadding, which covers the limb from toes to above the knee. The limb is then secured in a plaster cast of not more than three layers thick. The splint is applied snugly against the lightly plastered sole of the foot and brought into such relation to the leg as will allow its stem to lie along the outer side of the leg, parallel to its long axis and opposite the level of the lateral malleolus. It is then firmly secured by a sufficient number of turns of plaster about the foot and leg to make a strong cast, the knee joint being included in a position of slight flexion.

Provided no untoward circumstances arise, there is no need to disturb the parts, and they should not be disturbed if possible, for

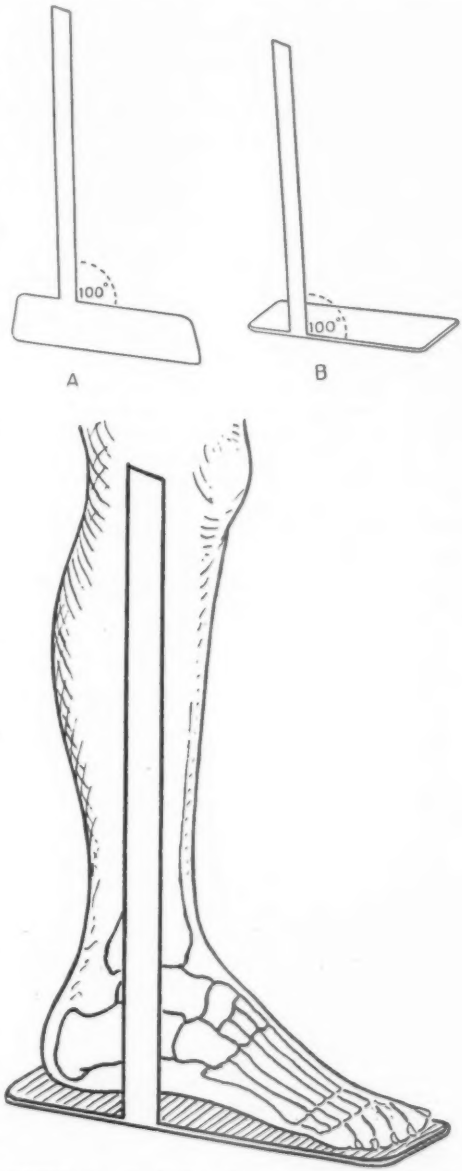

FIGURE V. Illustrating the contrivance for correct placement of foot in relation to leg at conclusion of operation.

(a) The splint cut from the flat piece. Note angle 100° between the leading edge and longer segment of the sole plate.

(b) The sole plate swung round at right-angles in the horizontal plane. The splint is for a right lower limb.

(c) The contrivance applied to the foot and leg, maintaining them at the desired angles.

a full three months. Where intertarsal fixation has accompanied ankle fusion the period should be extended for a further month. At the end of this time the plaster can be removed and replaced by a moulded posterior splint, which can be removed at will. Active mobilization of the mid-tarsal joint is commenced, if the ankle only has been fused.

Care is taken at all times, but particularly during the phase under discussion, to avoid dependency of the limb for long periods, in order to prevent oedema. A further measure towards the same end is provided by enveloping the limb at all times, except when it is under exercise, in a firmly applied crepe elastic bandage, extending from the toes to below the knee. The vis a tergo, developed by the muscle contractions incidental to exercise of the muscles controlling the joints of the toes and tarsus, is a third factor operating to prevent the tissues from becoming water-logged.

The X-ray evidence at this time is liable to be misleading and the confused bone shadow which is usually seen must not be taken to indicate bony ankylosis.

Provided there is no sign of adverse reaction at the ankle joint during this early phase of muscle movement, the plaster may be left off for lengthening daily periods at the end of the fourth month. Still using crutches, and now wearing a shoe, with the heel very slightly raised, the patient commences to rest the foot upon the ground when sitting down, and to bear very gradually increasing weight on the heel only, whilst he uses crutches. There is no need for me to stress the importance of grounding the patient thoroughly in the correct use of his crutches at all stages of his treatment.

In the continued absence of any pain, swelling or tenderness about the ankle region, the degree of weight to be borne upon the heel is gradually increased until about 50% of the body weight is being borne. The next phase is concerned with transferring some of the weight on to the forefoot. This is done very gradually, and finally the patient is allowed to dispense with his crutches and to walk with a guarding limp, as he gradually takes more and more weight upon the forefoot.

At this stage there may arise some complaint of pain about the front of the ankle region. Such an event is not without its use, as it serves as a guide to the amount of thrust and weight the patient can take upon the forefoot. A further useful watchdog is provided by the moulded plaster splint. The foot at all times should fit into this as comfortably and snugly as when it was first moulded. If it is found that the heel does not sit readily into position, all weight bearing must cease, and the limb should be maintained strictly controlled once more in the plaster.

X-rays about this time should begin to show evidence of true bony ankylosis. There should be no swelling, tenderness, or pain, after about six months and the patient should be able to walk strongly and well, without any sign of a limp.

INDUCTION OF FUSION IN TUBERCULOSIS OF THE ANKLE JOINT.

I have mentioned the question of induction of fusion in relation to tuberculosis of the ankle. My experience of the disease in this situation is extremely limited, but in one case the procedure about to be described wrought such rapid and gratifying results as to leave me in no doubt as to the part it played in curing the condition, and I see no valid reason why the same procedure should not be equally successful in other cases of tuberculosis of the ankle joint.

In 1945, I saw a youth of seventeen years of age suffering from tuberculosis of the right ankle joint. At three years of age he had commenced to show signs of trouble about the ankle region. A year later a sinus had developed near the joint. It had healed after two years. The disability had persisted, however, and for the greater part of his life he had worn a plaster splint, or some similar contrivance, controlling his foot and leg.

X-rays taken in 1935 showed gross destruction of the surfaces of the ankle joint with some sclerosis of the adjacent bone, indicating an attempt to heal. The sub-taloid joint was seen to be completely ankylosed. I was loath to consider amputation except as a last resort. (Figures VI and VII.)

It appeared to me that if, as I believed, rest to the joint was the best method of curing his disease, it was obvious that the value of the method depended upon the efficiency of the fixation. It seemed clear that plaster alone failed in this respect. I

decided, therefore, to fix the elements of the joint, without opening it.

On 4/10/35, I made a small incision over each malleolus and another a little above

FIGURE VI. Skiagram of patient W.C. taken on 4/10/35 just prior to operation. Long-standing tuberculosis of the ankle which had failed to respond to conservative treatment. The sub-taloid joint had been apparently similarly affected and had fused spontaneously some ten or eleven years previously.

the anterior lip of the tibia. Through each of these incisions I drilled a quarter-inch hole through the malleoli and the anterior lip of the tibia into the talus. In the case of the anterior incision I feared greatly for the success of the procedure I had embarked upon, when some tuberculous pus began to ooze through the wound. I had already prepared three bone pegs, carefully shaped and rounded to fit snug dowels into the drill holes. These were hammered home, the ends levelled off, and the wounds closed. The limb was secured in plaster.

FIGURE VII. Lateral skiagram of patient W.C. taken on 4/10/35.

An X-ray on 16/1/36, showed the tuberculous process to be completely healed. Final skiagrams on the 8/5/36, showed ankylosis to be completely established (Figure VIII). A small tuberculous ulcer developed on the anterior wound, but fortunately cleared up very shortly.

The procedure was simple and conservative. It fixed the ankle joint immovably and it is for this reason, I think, that the inflammatory process cleared up so dramatically.

I carried out the same procedure on two occasions with a view to providing complete fixation of tuberculous knee joints. The procedure in these cases was a complete failure. I think the length of the grafts, and the extent to which they had to lie within the joint without bone covering, accounted for the failure of the procedure.

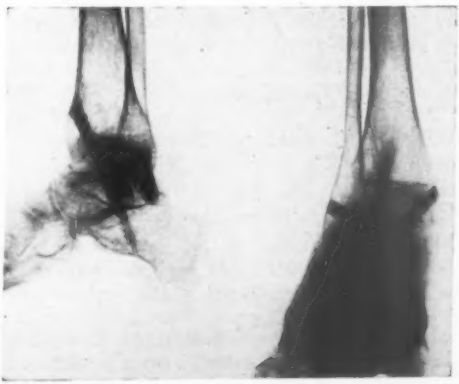

FIGURE VIII. Skiagrams of patient W.C. taken on 16/1/36. They show the condition at the ankle joint as healed and demonstrate the three dowels described in the text.

CHEMOTHERAPY IN INTESTINAL SURGERY.

By KENNETH W. STARR.

Sydney.

(Accepted for publication, 27/4/49.)

THE work of Strong, et al., has been largely responsible for the extension of the amazing modern methods of chemotherapy in intestinal surgery.

During the last five years, since the original introduction of these methods of pre-operative and post-operative management, the surgeon has tended to abandon drainage operations on the large gut and to concentrate on a primary anastomosis.

It has been found most efficacious to administer the chemotherapeutic substance for five days pre-operatively combined with mechanical bowel or gastric lavage daily. The drug formerly employed was sulphaguanidine 2 gms. (4 tablets) four-hourly by mouth, but during the last eighteen months phthalyl sulphathiazole 1 gm. t.d.s. by mouth has proved more acceptable from the patient's viewpoint, while proving equally efficacious. Crystalluria from absorption has been seen in one case only. This chemotherapeutic cover is continued with systemic penicillin therapy and continued for one week post-operatively.

The effect of chemotherapy begins to make itself evident about the fourth or fifth day by considerable reduction in the quantity and infectivity of the bowel contents. As these consist of a high proportion of bacteria, this is readily understood.

In my own practice, the safety of radical procedures has been considerably improved by the administration of these substances, and procedures which five years ago would have been regarded as dangerous may now be undertaken with relative immunity from serious infective complications.

I would like to indicate the abdominal lesions in which I have found pre-operative chemotherapy to be of the greatest assistance, and to discuss changes in technique which have been thus rendered possible.

GASTRIC SURGERY.

The two conditions in which pre-operative administration of these substances renders the operative management less difficult are gastrocolic fistula and carcinoma of the greater curvature (which may involve either the middle colic artery or the colon itself). In four cases of gastrocolic fistula, after one week of pre-operative preparation, operation has been undertaken, the colonic fistula closed and the stomal ulcer dealt with. In three cases gastrectomy has been performed, and in the fourth, gastroenterostomy reconstituted. One death occurred in uraemia in a patient aged 74 years, on the sixteenth day, and of those recovered, one patient subsequently developed a stomal ulcer on the gastrectomy stoma, necessitating vagotomy.

Three patients have been submitted to combined colonic and gastric resection for carcinoma. In each case the gastric anastomosis has been effected before the colon was joined by "end to end" suture anteriorly. One of these patients formed an anterior faecal fistula between the eighth and sixteenth post-operative days. One case has been alive and well for two years and the others, eighteen and fifteen months respectively.

COLON RESECTION.

Nineteen cases of resection of the right half of the colon and twenty-five cases of resection on the transverse and left sides of the colon have been performed with primary anastomosis. In the first series, one patient died from acute gastric dilatation, and in the second series, one patient died on the fourth day from leakage at the anastomosis, the carcinoma being in the lower part of the descending colon. This group includes five cases of Crohn's Disease, of which two occurred in the transverse and one, a double lesion, in the sigmoid. There have been no cases of leakage, apart from those mentioned, no late pericolic abscesses, and no evidence of wound infection. One patient with Crohn's Disease died in the country twelve

months after operation from acute intestinal obstruction.

ANO RECTAL CONDITIONS.

In three cases of stricture of the rectum following dysentery, the narrow zone was exposed through a parasacral incision, the stricture excised and the gut reconstituted in layers with silk sutures. One of these patients has subsequently formed two wound sinuses, through which silk sutures are discharging, but there is no evidence of recurrence of the stricture.

Eighteen cases of abdominoperineal resection of the rectum have been performed, with one death, due to pulmonary embolism on the sixth day in a patient suffering with a recurrence following a conservative resection. Twelve cases of conservative resection of the rectum are also reported. Where the resection was sufficiently high as to justify an "end to end" intra-abdominal anastomosis, the patient's progress was uninterrupted, with one subsequent death two years after the operation, due to recurrence, as already mentioned.

Where the pullthrough and Bacon type of resection has been attempted, necrosis of the gut has also promoted some degree of pelvic cellulitis, and in three cases this has been so severe as to cause considerable stricture formation in the rectum and to warrant colostomy. Of the remainder, the cases under 45 years of age have good control, but the older group are in considerable trouble with incontinence, and I am of the opinion that until my technique is very much improved, colostomy is a preferable state in this latter group.

Rectal prolapse continues to present a high recurrence rate even in the most capable hands. Of nine cases here reported, five have been small prolapses of the anal type and four massive prolapses. The former group appear to me to be associated with considerable weakness of the external sphincter muscle, and the most effective method of dealing with this in my hands is to employ a double sling of fascia lata from each gluteus maximus, which reduces the size of the anus and provides an ancillary muscular control, resulting in continence. In one of these cases, a gunshot wound of the cauda equina, with loss of sensation of S.3.4.5. segments and incontinence, considerable difficulty was experienced in the healing of a pressure sore in 1943, and a similar state appears to have affected one of the perianal wounds, with loss of one of the fascial slings. Another early case has discharged silk sutures through a sinus. Subsequently only stainless steel wire sutures have been employed and healing has always taken place by first intention.

The massive type of prolapse appears to me to be associated with inadequacy of both the levator and external sphincter muscles. All cases operated upon were recurrent following previous attempts at cure. One was resected (procto-sigmoidectomy), but a fascial sling operation had subsequently to be performed to provide continence of the external sphincter. The remaining three cases have been dealt with by an operation which first places fascial slings about the external sphincter and subsequently through the left inguinal laparotomy incision, deals with the procto-sigmoid prolapse and enlarged Douglas' Pouch by the method of Roscoe Graham. There has been no recurrence as yet in this group.

Thirty-seven cases of fistula-in-ano have been treated by primary closure during the last five years. Four of these cases have recurred and required subsequent operation. The fistula, including its secondary tracts, is completely excised, dividing anal mucosa and sphincter muscles wherever necessary.

The mucosa is sutured with mattress catgut sutures, the sphincter muscles with interrupted stainless steel wire sutures, and the ischio rectal cavity closed by "through and through" widely spaced stainless steel wire sutures, with drainage of the cavity. The recurrences have been associated with failure to drain the cavity and collections occur in the wound during the early stages of convalescence. The ends of the wire sutures may be very irritating to the sensitive perianal skin, and they are therefore left very long and fixed with a silk suture wide out on the buttock to prevent this complication.

Of these 37 cases, 18 were primary and 19 recurrent at the time of operation. Five cases of fistula recurrent after previous surgical attacks have been encountered in which the fistula extended above the levator muscle. Two of these cases have remained cured after the excision, but three have

recurred, and I regard them as the most formidable of perianal problems. In one case, carcinoma was reported in the recurrent ischio-rectal fistula. A cavity the size of the palm of the hand remaining after the radical excision was closed by rotating a large buttock flap. Primary healing occurred, but a recurrent fistula has presented under the base of the flap eight months after operation. It is probably associated with my failure to close the dead space under the flap at the time of the plastic procedure.

The saving of time in healing and nursing in this method cannot be too strongly stressed.

Primary closure of fistula-in-ano raises the question as to whether it is now justifiable to close the anal wounds after haemorrhoidectomy, with reasonable chance of successful primary healing.

I have restricted primary closure to dealing with secondary haemorrhoidal masses which remain after the three primary haemorrhoids have been resected by ligation. The fear of stricture has always prevented me from performing the Whitehead type of operation in these cases. This fear may not now be warranted, but in dealing with the secondary haemorrhoids sufficient mucosa must be left to obviate its possibility. Therefore, through the incision on the skin surface at the base of the secondary haemorrhoid, a sub-mucous elevation of the mucosa is performed, the haemorrhoidal veins withdrawn through the incision and ligated by a catgut suture prior to resection. The mucosal flap after resection of redundant skin is sutured in place with interrupted, fine chromic catgut sutures.

In 45 cases of haemorrhoidal resection, 11 cases have required this procedure and there has been no difficulty with haemorrhage or stricture formation.

Fissure-in-ano of the chronic or indolent type usually requires sphincteric division with excision of the fissure. I have never attempted primary closure with this condition because I believe that the local inflammatory reaction precludes ready primary healing.

Some of my own results leave much to be desired. On the other hand, it is worthy of comment that the introduction of chemotherapy has resulted in greater safety in intestinal procedures, so that the once much dreaded intestinal contents have lost much of their evil association with virulent infection. In other words, it would appear that with improvements in technique and increasing employment of chemotherapeutic detoxication of the gut, the rectal tissues may in the future be regarded, from the surgical viewpoint, as are the other tissues of the body, and corresponding operative procedures performed upon them.

ACKNOWLEDGMENTS.

It is with pleasure that I duly acknowledge the help of the Librarian of the Royal Australasian College of Surgeons in preparing the bibliography, and of Mrs. M. Hamer, who corrected and typed the manuscript.

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FENESTRATION.

By Eric Gutteridge.

Melbourne.

(Read at the 22nd Annual General Meeting, June, 1949.)

(Accepted for publication, 6/4/49.)

FENESTRATION is a surgical procedure which provides an artificial aperture in a region of the otic capsule to replace the function of an ankylosed tympanostapedial syndesmosis, the articulation of the stapes and the fenestra vestibuli. A bony ankylosis occurs in otosclerosis; ligamentous adhesions impair or impede totally stapedial movement in chronic adhesive otitis media.

Otosclerosis is a bony dystrophy affecting the otic capsule, a spongification of slow progression with an excessive number of marrow spaces and thin-walled vessels. Osteoclasts are visible at the advancing margins. Osteoblastic activity follows with laying down of trabeculae of new bone. The process may extend in the otic capsule and involve the oval window, destroy the lining articular cartilage, affect the foot-plate of the stapes and produce a bony ankylosis as new bone is laid down, or may attack contiguous regions of the round window and cochlea.

The attacked bone is enlarged and nodular, forming irregular nodes of the promontory and within the cochlea. Pressure upon the basal turn of the cochlea and upon the cochlear nerve causes nerve or cochlear deafness.

Sites of predeliction are in the region of the fissura ante-fenestrum, between the cochlea and the vestibule, anterior to the foot-plate of the stapes, with spread to the oval window and ankylosis of the stapes; in the region of the round window (fenestra rotundum); involving the basal turn of the cochlea.

As the bony dystrophy is slowly progressive throughout life, there may be a spread to the cochlea. The rapidity of the development appears to be proportional to the age of onset; the younger signs appear of the disease, the earlier will cochlear deafness eventuate. Onset later in life does not appear to lead to total deafness.

The type of otosclerosis in which signs indicate that the stapes is immobilised and the fenestra vestibuli inactive by ankylosis of the stapes to its margins is the one type of the disease for which fenestration is of value. A third fenestra is opened to replace the fenestra vestibuli.

In the younger, rapidly progressive otosclerotic, this relief may be for a short span of time, and cochlear involvement and deafness of nerve type may ensue.

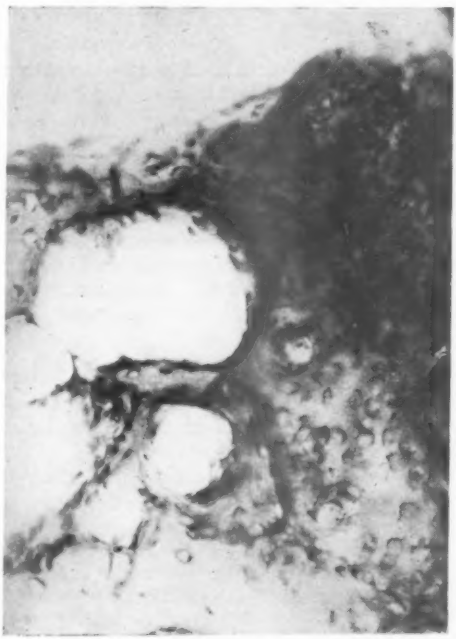

FIGURE I. Otosclerosis of the foot-plate of the stapes Lacunar erosion by osteoclasts with deposition of web-like bone and finger processes of bluish tissue bone (blue mantles). x 250.

Sound waves entering the cochlea through the round window produce vibrations of the membrana secundaria, transmitting to the endolymphatic fluid in the ductus cochlearis a wave affecting the appropriate fibres of

the basilar membrane. The membrana vestibuli with the footplate of the stapes acts as a relief valve. With a fixation of the stapes, this relief valve mechanism does not function, and the incompressibility of the endolymph prevents transmission of the fluid wave to the basilar membrane; and deafness of the conductive type appears.

Conductive deafness with fixation of the stapes is shown by a negative rinne test, the tuning fork is heard better by bone conduction that at the meatus by air. The increase of air pressure in the auditory meatus does not increase the sound of a tuning fork applied to the mastoid process (Gelle's test).

Selection of cases for fenestration is important.

Age: The deterioration of hearing after the age of fifty appears to be accelerated in otosclerosis. Success is not readily achieved after this year.

Bone conduction tests: A marked negative response to the tuning fork on the mastoid process shows little or no nerve involvement. The audiogram will show the lower frequencies to be unimpaired by the bone conduction scale; the upper 4096 d.v. may demonstrate a recession of 10 to 20 decibels (by Western Electric audiometer). An increased drop is indicative of commencing nerve involvement and experience has shown that any improvement will be small, and tend to diminish.

The audiogram by air will be of the characteristic flat depression of hearing acuity. A loss of 50 decibels over the range is of serious import. At the expected gain is of the power of 30 decibels, fenestration will not bring the hearing up to general conversational level. A descending curve in the upper frequencies will usually be reflected in a similar drop at 4096 in the bone conduction curve, and should contra-indicate the operation.

Paracusis willisii, or the apparent increased hearing capacity in the presence of ambient noise, appears with stapedial fixation, and is lost as nerve involvement progresses. 75 per cent. of cases where this feature was noted showed satisfactory gains in hearing. Absence of this paracusis is of bad import, as showing nerve depression.

Drum appearances: A thin transparent tympanic membrane without signs of past catarrhal inflammation—scars, adhesions and white plaques. The flamingo blush of the otosclerotic focus around the oval window is seen in the younger subjects, and indicates an active focus, but should not militate against success.

Chronic adhesive otitis media develops plastic deposits in the middle ear. String-like adhesions extend from the malleus and incus to the stapes and the margins of the oval and round windows. The stapes is bound down and partially immobilised. The signs of stapedial fixation appear. The audiogram shows a loss over the whole field with a depression of the 4096 d.v. by air and bone conduction. The possibility that similar plastic deposits have affected the membrane secundaria of the round window militates against successful fenestration.

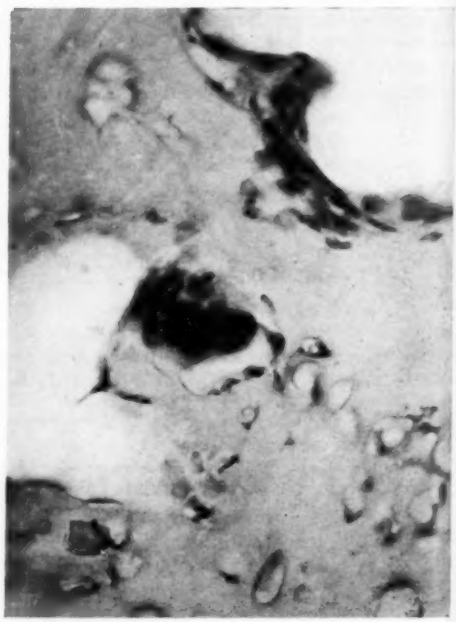

FIGURE II. Otosclerosis of the foot-plate of the stapes. A large multinucleated cell in a lacuna. Spread of otosclerotic deeply stained cells into the normal bone at the margin of a bone space. x 525.

The fenestration operation has been evolved since, in 1876, Kessel attempted to remove the stapes with the idea of replacing the footplate with a movable cicatricial mem-

brane. With asepsis, the stapes footplate can be removed sub-periosteally without opening the labyrinth. There was no improvement in my one case in which this was the sole procedure. In 1896, Passow trephined the promontory with temporary improvement. Popper (1946) has suggested this again, advising opening the scala vestibuli in the superior coil and the scala tympani in the basal turn of the cochlea. I have elevated the muco-periosteum over the postero-inferior region of the promontory and curetted the outer wall of the basal turn of the cochlea in close proximity to the round window. The endosteum of the scala tympani was exposed as a dark membrane of a circle of 2 m.m. The muco-periosteum was replaced, and the tympanic membrane packed against the promontory. Where this was done as the sole fenestra, no improvement in hearing ensued. When combined with a fenestration of the lateral semi-circular canal, no additional hearing gain was demonstrable.

In 1947, the superior semi-circular canal was exposed by a temporal approach. The cerebral dura was elevated. The arch of the canal was cut away with dental elevators, and the endosteum of the canal removed. The dura then became the vibrating membrane, acting as a relief valve. There was no improvement in hearing. This approach might be of value where infective processes in the middle ear preclude a local labyrinthotomy.

In 1904, Barany established a labyrinthine fistula in the posterior vertical canal. In 1917, Holmgren established a fistula on the superior vertical canal, resecting the bone between the dura and the canal, believing that this would lead to a primary healing of the fistula.

In 1914, Jenkins opened the lateral semi-circular canal. Holmgren in 1922, Sourdille in 1924, and Lempert in 1940, have established the route as the standard operation.

ANAESTHETIC PROCEDURE FOR FENESTRATION OPERATIONS (DR. GORDON V. STANTON).

The following anaesthetic procedure has been used in 100 cases for the fenestration operation. The subjects were all healthy patients, the majority in their forties—the youngest 14 years, and the oldest 55 years. The sexes were equally divided.

The anaesthetic requirements were:—

(1) Safety of the patient.

(2) For the surgeon: A quiet field, with the minimum of bleeding and of interference in the operative field.

(3) In the earlier cases the use of electrical appliances.

Previous experience in the value of combination of pentothal and local anaesthesia in prolonged neurosurgical cases, not requiring muscular relaxation was a factor in the choice of this procedure. Combined with basal narcosis, to be described, it has been satisfactory. The basal narcosis used is less than that given by Dr. Braunower, the anaesthetist working with Dr. Lempert in New York.

DETAILS OF BASAL NARCOSIS.

The night before operation the patient is given Nembutal gr. 1½.

1. Two hours prior to operation—Nembutal gr. 1½.
2. One and a half hours prior to operation—Omnopon gr. ⅓, Hyoscine gr. 1/150 or 1/100.
3. One hour prior to operation—Nembutal gr. iii.
4. Half an hour prior to operation—Omnopon gr. ⅓ or gr. ¼, and repeat Nembutal gr. 1½ if required.

The dosage must be varied with the individual patient. The patient is examined for this purpose the night before operation and prior to repeating the omnopon.

Prior to the injection of the local anaesthetic the patient is given continuous intranasal oxygen at 2-3 litres per minute—a wire frame is placed over the head of the patient and the arm opposite to the ear to be operated on is placed on an arm board.

The average duration of operation was 150 minutes. Intravenous pentothal was usually given when the labyrinth was opened or before if the patient complained of discomfort. Eight per cent. of patients required no pentothal. The average dose used was .9 gm. given over 70-80 minutes.

The initial dose of pentothal—using a 2½ per cent. solution is given with caution as the individual variation is great, and apnoea may result. A constant watch is maintained on the rate and depth of respiration—the colour of blood in the wound, and the pulse rate.

The post-operative reaction time varied from nil to three hours. No complications have arisen from the prolonged reaction time, but efforts to shorten it vary from the I.V.

FIGURE III. The incisions in the fenestration operation.

injection of 2-3 c.c. of coramine, to the use of carbogen inhalations at half-hourly intervals. Dr. Meals has recommended the I.V. use of 1,000 c.c. of 10 per cent. glucose in distilled water as an analeptic.

As the excretion of pentothal may be associated with carbohydrate metabolism, this appears to be rational treatment. A 10 mg. dose of amphetamine sulphate subcutaneously has also been recommended to overcome post-operative respiratory depression.

Complications during anaesthesia:

The attempted use of an oral airway when anaesthesia was too light caused coughing in several patients.

The use of hyoscine caused salivation to be at a minimum. Apnoea was not encountered.

Post-operative complications were minimal. Giddiness and vomiting were considered to be the result of surgical rather than anaesthetic procedure.

No cases of phlebitis or pneumonitis developed—all patients having received routine penicillin.

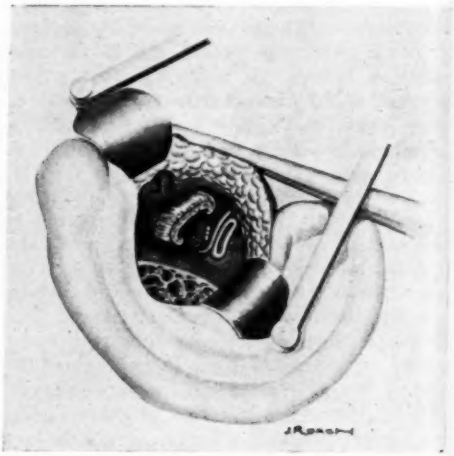

FIGURE IV. The completed operation. The opening of the lateral semi-circular canal is shown above the facial nerve. The meatal wall flap is ready to place over the fenestrum.

CONCLUSION.

A satisfactory method of anaesthesia using a combination of basal narcosis, local anaesthetic and pentothal has been described. The use of intravenous analgesics offers much in shortening the post-operative reaction time.

Local anaesthesia—

Novocain 2 per cent. oz. i
with Adrenalin 1 in 1000 c.c. i.

Injections are made to the periosteum over the mastoid process, above the external auditory meatus, beneath the periosteum of the external auditory canal on its superior and anterior segments, anterior to the mastoid process caudal to the auditory meatus.

The Lempert pre-auricular incision vertical to the meatus is made down to the bone and continued posteriorly, incising the posterior wall of the auditory canal on the level of attachment to the mastoid process. A meatal flap is cut from the concha, denuded of cartilage of meatus and concha. The periosteum is elevated.

With a dental drill, the mastoid antrum is entered and completely excavated. The outer attic overhang is removed with a fissure drill and small sharp spoons. The muco-periosteum of the meatus is separated from the bony superior and posterior walls down to the tympanic ring. The facial ridge is removed flush and the bridge thinned and removed, the membranous meatal wall being gently elevated from the tympanic ring. The incus is disarticulated from the malleus and stapes, and taken away; the head of the malleus is amputated. The flap of the superior wall of the meatus, which will cover later the fenestrum, is cleaned of superfluous connective tissue, incisions made at its anterior and posterior limits down to the tympanic membrane, and the flap gently retracted downwards out of the way. The lateral and superior semi-circular canals are defined by a small curette. The next stage is the exposure of the membranous canal and the vestibule. No drilling is done. The bone dust inseparable from the use of the drill may enter the opening made in the bony canal, or adhere to the surface of the meatal flap to cover the fenestra. The arch of the external canal is curetted with Lempert 0000 curette on its superior presentation. A stream of normal saline drips into the anterior vestibular region, and the aspirator posteriorly removes bone dust and fluid. Ash's angulated sharp dental excavators remove bone rapidly, and the cranked extremities permit of entrance into difficult angles under visual control. The blue line of the membranous canal appears and is pursued over the vestibule and posteriorly until the lateral canal turns deeply inwards. Endosteal bone is removed to the facial canal, the enchondral bone grooved above and below the canal. The lateral canal is then opened from the vestibule as far posteriorly as possible. The margins of the canal are broken out with the Ash excavators to achieve the widest exposure and the greatest width of fenestrum. All bone removed with the excavators is washed away by the freely flowing stream of saline, and all curetting is done away from the canal. The vestibule is exposed. The superior canal may be exposed near the tegmen tympani. The downward receding curve of the superior canal forms a deep buttress of bone over the upper part of the vestibule. It is doubtful whether it is necessary to remove this. The wide exposure of the lateral canal to its full length as a fenestra should be sufficient.

The endosteum now exposed through the bony aperture appears as a white membrane. The endosteal needle teases and shreds the endosteum, floating in the stream of saline, and is cleanly removed. The membraneous canal may be visible in the depth of the fenestra as a red line with the dilated ampulla at the vestibule.

The flap is placed over the fenestra and packed in place with two inches of ½ inch gauze containing a solution of penicillin. A piece of rubber dam is inserted into the meatal cavity and filled with sponge fragments. The conchal flap is adjusted to cover the mastoid cavity.

The sponge and rubber is removed on the 5th day, and the ear loosely packed with vaseline gauze, replaced on alternate days. Penicillin-sulphonamide powder is insufflated daily.

The penicillin gauze strip holding the meatal flap in position over the fenestra is removed on the 14th day. Vaseline gauze packing, to keep the meatal wound open for epithelialisation to become complete, is replaced each second day after insufflation with penicillin-sulphonamide powder until the 21st day.

Subsequent treatment is by insufflation of the same powder unless a sensitisation occurs with dermatitis, when boracic acid and talc powder 10 per cent. or boric iodide powder is substituted.

The post-operative use of penicillin—100,000 units thrice daily—injections, and the use of a head-rest to control the movements of the head are advisable.

RESULTS.

120 fenestration operations have been performed.

107 are reported.

64 have gained 25 decibel or greater improvement .. .. 60 per cent.

5 have gained 15 decibel improvement and are regarded as partial .. 5 per cent.

13 had immediate gain, but deteriorated in a year .. .. 12 per cent.

2 were re-operated with success; 2 re-operated without improvement.

30 showed no improvment after the operation .. .. 26 per cent.

Of Class I cases—with a high bone conduction as demonstrated on the audiometer, 36 out of 40 were successful.

Of Class II cases—with falling bone conduction or over 50 years: Of 24 operations, 12 were successful, 2 partial gains (15 decibels) and 10 failed.

One patient with the signs of stapedial fixation, with evidence of adhesive otitis media on operation, did not show any improvement in hearing.

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SURGICAL TECHNIQUE.

THE TREATMENT OF FRACTURE DISLOCATION OF THE CERVICAL SPINE BY INTERNAL FIXATION.

By P. J. KENNY.
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(Accepted for publication, 17/6/49.)

INTERNAL fixation of the fractured neck is not a new manoeuvre, for the use of wire in this regard was first described by Hadra in 1891, and Lane (1892) described a method of silk fixation, as did Mixter and Osgood (1910). Ryerson and Christopher (1937) reported treatment by internal wire fixing and fusion, and more recently Rogers (1942) has reported a series treated by wiring and fusion. It is felt, however, that the procedure is not universally known, and it is submitted that the method, although it carries the added risk of an open operation, is so much more humane than the accepted means of treatment by continued traction and plaster or other collars, that it is justifiable to bring it to further notice. The usual plaster immobilisation entails a great deal of suffering on the part of the patient, which, even if it is a dire remedy for a dire disease, is hardly justified if it can be avoided.

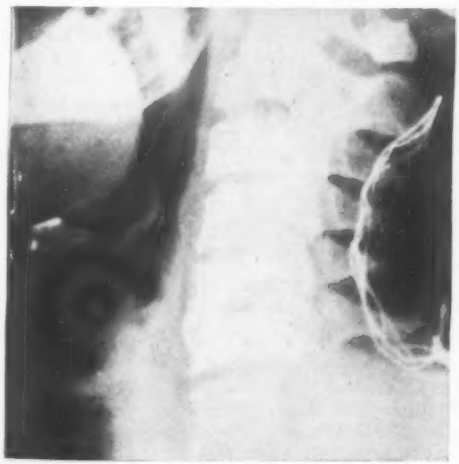

FIGURE I. Case 1. Wire in position after operation.

The deformity should be reduced as soon as possible by gradual weight extension applied through Crutchfield's tongs. When reduction is satisfactory, a front plaster cast should be moulded to the chest, neck and head — that is, the front half of the usual collar. When this has set, the patient, still with traction supplied by an assistant, can be anaesthetised and then turned into the position on the operating table.

THE OPERATION.

A midline incision from the occiput to the seventh cervical spine exposes the spinous processes. The neck muscles are stripped subperiosteally from the spines and retracted laterally until the laminae and articular processes are in view. Bleeding can be controlled by diathermy, packing and patience. A visual check of reduction is now possible. In those cases which cannot be reduced by traction and gradual manipulation whilst under traction, facetectomy and reduction can be carried out. At this stage it is advis-

FIGURE II. Case 1. Showing the figure of 8 plication of the wire around the spinous processes.

able to take an X-ray with a silver clip to identify the erstwhile dislocated vertebral spine to ensure that reduction has occurred and to establish beyond doubt the vertebrae involved. Stainless steel wire (Babcock No. 24) is then plicated in figure of eight manner around the bases of the spines from two vertebrae above to two below the site of dislocation. The wire can be easily passed through the interspinous ligaments when threaded on a stout needle, but some difficulty can be anticipated in getting it to grip the spines tightly, which it must do.

Rogers (1942) and others advocate passing the wire through a small hole drilled in the base of each spine, also the tucking of an osteoperiosteal graft under the wire between the spine and the articular processes. This has not been done in the present series. Close apposition of the wire to the spines and a tight finish are essential. The muscles are then coapted, either by thin wire or silk, and the wound is closed.

On recovery from the anaesthetic, the traction is removed and the patient can sit up, and indeed get up at once. A felt-type collar is advocated for some cases, but, provided the wiring is satisfactory, is not essential — for example, Case 1 had no further immobilisation and sustained without damage a few weeks after discharge a fall identical with his original injury.

The patients so treated in this small series have been very comfortable and have all expressed a great preference for this form of treatment as compared with plaster immobilisation.

CASE 1.

A.B., aged 65.

This patient fell and struck his head on 11/12/47. He was not concussed, but complained of some soreness in the neck. Examination revealed tenderness over the cervical spines, but no neurological signs were present. An X-ray showed a forward dislocation of the fifth cervical vertebra on the sixth. He was placed in a plaster collar and sent by ambulance to Sydney, a distance of sixty miles. Check X-ray on arrival showed the displacement was unchanged.

Treatment.

The collar was removed and under Pentothal anaesthesia Crutchfield's callipers were applied to the skull and traction was begun with fifteen pounds, gradually increasing to forty pounds.

Satisfactory reduction was effected on 12/12/47, and the traction was reduced to twenty pounds. On 3/1/48 he developed delirium tremens, and in his delirium, re-dislocated his neck. The traction was again increased, but it was not until 9/1/48 that the vertebral alignment was restored. The next day he developed pneumonia, again became delirious and again re-dislocated his neck. Re-application of full traction again reduced the condition.

Following this, the patient, a fairly heavy drinker, was very restless and hard to control, and on 20/1/48 succeeded in displacing the tong of the calliper on one side. Once again his fracture dislocation occurred. The callipers were re-applied and full traction once again reduced the condition.

It was decided that the patient would not stand any more prolonged traction and, furthermore, was in danger of developing a pressure sore on the occiput, and accordingly arrangements were made for internal fixation by wire.

A front plaster cast was fitted to the chest, neck and head, forming the front half of the usual permanent plaster collar, and with an assistant providing traction, the patient was anaesthetised and then turned on to his face. The spines, laminae and articular processes were exposed, reduction checked visually and by X-ray and the processes wired in figure of eight manner from the second to the seventh cervical segments. Light traction of twenty pounds was provided until recovery from the anaesthetic, and next day the callipers were removed, and the following day he was allowed out of bed. Penicillin was given in the first four post-operative days, but no further immobilisation was necessary.

Repeated X-rays showed the hitherto unstable fracture dislocation to be in good position and he was allowed out of hospital three weeks later. He then returned to his country home and celebrated his home-coming with friends, during which he fell and sustained an injury identical with the one that had caused his fracture.

He was happy to report back a week later with the statement that he had done no damage to either neck or wire, which facts were verified by X-ray. He has been X-rayed at intervals up to the present time, and there has been no change in the position.

FIGURE III. Case 2. Wire in position two weeks after operation.

CASE 2.

L.F., aged 21, was playing football on 9/5/48 and was dumped on his head. He was able to rise, but had pain and stiffness of his neck, and tingling along the radial sides of both forearms.

On examination, there was tenderness over the spines of the fourth, fifth and sixth cervical spines and the neck muscles were held rigid. There was hyperaesthesia along the radial sides of both forearms, and loss of power of the short external rotators and abductors of the left shoulder. X-ray revealed a forward dislocation of the fourth on the fifth cervical vertebra.

Diagnosis.

Fracture dislocation of the neck with involvement of the left fifth cervical nerve.

Treatment.

He was placed in bed with a halter extension of ten pounds. On 10/5/48 Crutchfield callipers were applied to the head and traction begun with fifteen pounds, gradually increasing to forty-five pounds. Satisfactory distraction was obtained, but reduction did not take place, even with flexion and extension of the head as added manipulative procedures. The articular processes of the fourth vertebra would not ride over those of the fifth. After four days of repeated attempts at reduction, with no success, traction was reduced to fifteen pounds and a front plaster cast was applied. He was subjected to operation on 17/5/48, the laminae and articular processes were exposed, and it was found that the lower left articular process of the fourth vertebra was firmly caught in front of the upper articular process of the fifth. Traction and manipulation under direct vision failed to reduce this, and it was necessary to remove the upper left articular process of the fifth vertebra. Following this, the dislocation was satisfactorily reduced and was checked by X-ray.

Stainless steel wire was plicated around the bifid spines of the third, fourth and fifth vertebra, but it was noticed that even then there was some abnormal mobility of the cervical spine. The wound was closed and the patient returned to bed. He was provided with a Forrester-type felt collar as added means of support, and also with an abduction frame for the left shoulder. He was allowed out of bed after four days, and given physiotherapy attention to the paretic shoulder muscles. He was discharged from hospital on 10/7/48 and repeated X-rays showed that the position of his neck had been maintained and he was showing recovery in his shoulder. The position of the neck remained the same except for a slight degree of slipping of the fourth vertebra forward on the fifth, and on 15/12/48 he was allowed out of his collar, the shoulder by this time showing a full return of function. He has been checked at intervals since up to 15/1/49, and has had no trouble with his neck, and X-ray has revealed no change.

CASE 3.

W.D., aged six, suffered a fracture dislocation of the second cervical vertebra on the third on 23/10/47. This was easily reduced by hyperextension of the neck and a Minerva-type plaster collar was applied. This was removed on 6/2/48, and X-ray

FIGURE IV. Case 2. Movement of neck. End result.

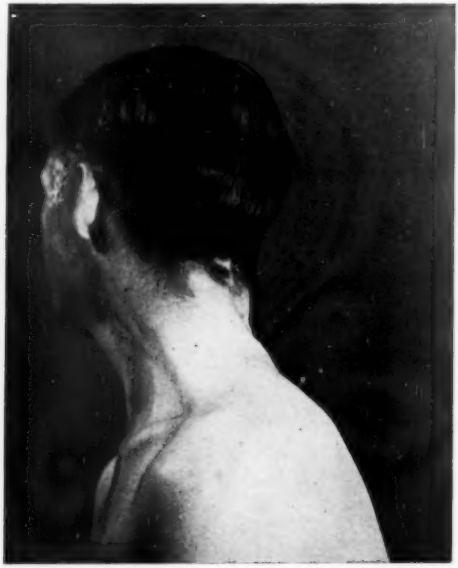

FIGURE V. Case 2. Movement of neck. End result.

showed the cervical spine to be normal in alignment.

Following the removal of the plaster, the child's mother noticed there was a gradually increasing flexion of the neck, until on 12/2/48 the chin was on the chest and voluntary extension of the neck was impossible. X-ray showed that the original displacement had recurred.

Reduction was again easily effected, this time by a halter collar, and on 20/2/48 he was submitted to operation, and the spinous

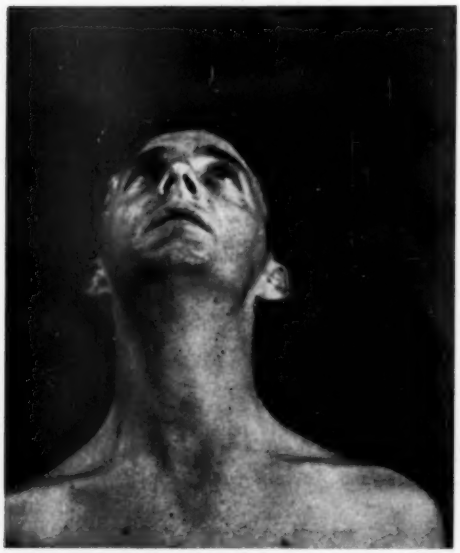

FIGURE VI. Case 2. Movement of neck. End result.

FIGURE VII. Case 2. Movement of neck. End result.

processes of the second, third and fourth vertebrae were wired.

A plaster collar was applied for one week and then removed. Check X-ray showed that the spine was in good position. He was discharged on 5/3/48, and since that date his neck has remained in good position and he has led a normal schoolboy existence.

FIGURE VIII. Case 3. Wire in position.

SUMMARY.

1. The treatment of fracture dislocation of the cervical spine by internal fixation with wire is described.

2. It is submitted that the method is more humane than the usual means of immobilisation by plaster or other collars, and is more satisfactory, insofar as it has worked well in cases refractory to other means of treatment.

3. Reports of three cases are appended.

ACKNOWLEDGMENTS.

I am indebted to the medical and nursing staff of St. Vincent's Hospital for their helpful co-operation in these cases, and to Mr. Douglas Miller I am as ever grateful for his inspiration, assistance and advice.

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THE APPROACH TO THE UPPER ABDOMEN.

By CHARLES GALE.

Geelong.

(Accepted for publication, 12/11/48.)

THE advent of controlled respiration made practicable combined abdomino-thoracic incisions, of which that of Humphreys' (1946) appears to be of most value.

The use of this incision for high gastric lesions at times reveals conditions that may be readily handled without extending the abdominal portion of the incision into the thorax. This suggested that other upper abdominal lesions may be best approached through an abdominal incision resembling the lower portion of Humphreys' incision. Two incisions thus require description, namely, the right and left upper oblique abdominal incisions.

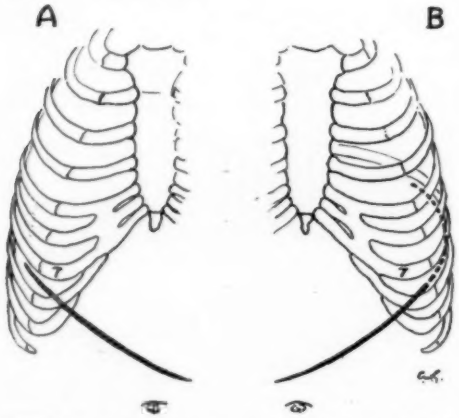

FIGURE I. A. The right upper oblique incision. B. The left upper oblique incision and its extension to form Humphreys' incision.

A. The right upper oblique incision (Figure I A) gives a good approach to the gall bladder and its ducts and to the first and second parts of the duodenum. After retraction, the surgeon looks down and slightly to the patient's left upon these structures. There is never occasion to lean over the patient, as is so often necessary with a vertical incision.

The patient lies supine with a gall bladder "rest" in position.

The incision commences one inch above and to the left of the umbilicus and passes with a slight curve towards the right rib margin and then along the seventh intercostal space for a distance of four inches from the costal margin. The incision is so placed that a straight line connecting its ends makes an angle of 30 to 40 degrees with the patient's waist line (Figure I A).

All structures are cut along the line of this incision. The incision is deepened until the anterior rectus sheaths and linea alba are exposed medially and the muscle fibres of the external oblique muscle laterally. The fibres of the latter on the chest wall lie parallel to the skin incision. These are split through their whole exposed length to the edge of the rectus sheath, the anterior sheath then being incised. Retraction of the external oblique fibres reveals the areolar tissue over the costal cartilages and their adjacent ribs and intercostal muscles. The rectus muscle is divided by a series of gentle scalpel cuts, the vessels being picked up in turn as they become exposed. The divided muscle retracts but slightly. The posterior rectus sheath and peritoneum are incised lateral to the falciform ligament and the incision carried laterally along the line of the skin incision right to the rib margin, the internal oblique and transversus muscles and peritoneum being cut as one piece. The incision is carried to the left through the falciform ligament (which is divided between clamps and ligated), the linea alba and the left anterior and posterior rectus sheaths for about one inch, the left rectus muscle being retracted to the left (Figure II). Application of forcible retraction to each wound edge just medial to the costal margin causes the transversus muscle and associated peritoneum to tear laterally for ¾ of an inch deep to the rib margin so that a triangular opening is

established with its base formed by a four-inch length of costal margin covered only by areolar tissue (Figure III). It is the prolongation of the incision for four inches out along the intercostal space and through the structures covering the ribs and intercostal muscles that makes this retraction possible. Application of appropriate retracting "hands" over scarfs (Figure III) results

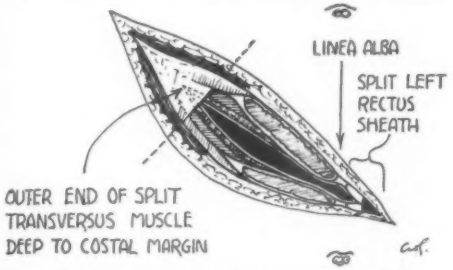

FIGURE II. The completed right upper oblique incision.

in good exposure of the biliary apparatus and the first and second parts of the duodenum.

Closure. At the edge of the incision the peritoneum, except where it is reflected to form the falciform ligament, is moderately firmly attached by the fascia transversalis to the deep surfaces of the posterior rectus sheath and transversus muscle. The fibres of the sheath and of the fascia run parallel to the incision so that all sutures grip these structures firmly. At this level the muscle fibres of the transversus muscle extend medially to within 1½ inches of the linea alba (Figure II).

The suturing is commenced at the left end of the incision, the suture approximating the peritoneum and rectus sheath behind the left rectus muscle. The peritoneum, in conjunction with the linea alba, right posterior rectus sheath and transversus muscle belly in succession, are sutured to within 1½ inches of the costal margin. A second suture then picks up the split peritoneum and transversus muscle at the right end of the incision on the deep aspect of the costal cartilages and this suture is continued to the left to join the first suture. This method of closure is easier than where a single suture is used, no matter from which end the latter is commenced. This suture line, by virtue of the above anatomical features, is found to provide very firm closure.

Two or three interrupted mattress sutures approximate the right anterior rectus sheath and the cut right rectus muscle belly, the needle being inserted ⅜ of an inch away from the cut edge of the sheath, the bite

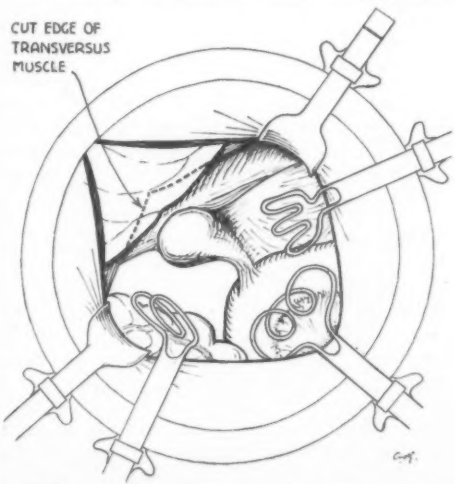

FIGURE III. The exposure obtained with the right upper oblique incision after retraction with the author's retractor.

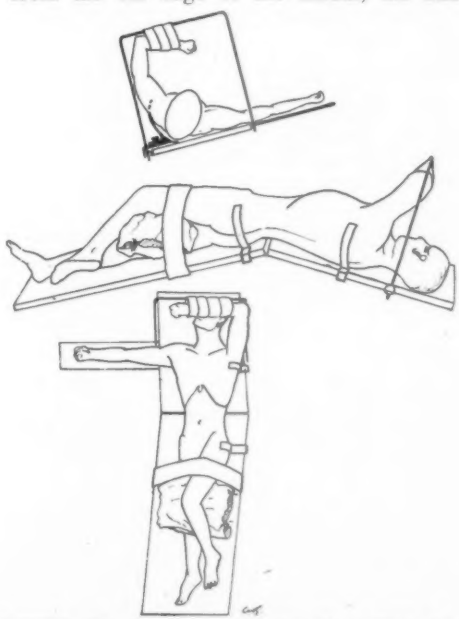

FIGURE IV. The positioning for the patient for Humphreys' incision and for those cases where thoracic extension of a left upper oblique incision is likely to be required (after Humphreys).

then including the whole thickness of the muscle. These are tied only sufficiently tightly to ensure apposition of the cut muscle belly.

In turn, the left anterior rectus sheath, the linea alba, the right anterior rectus sheath, the split external oblique muscle and the internal oblique aponeurosis are sutured. The internal oblique muscle lateral to the rectus at this level is a thin aponeurosis with its fibres running vertically upwards and slightly inwards. Its lateral edge lies in front of the costal margin and gradually fades outwards into areolar tissue over the chest wall. The skin and fat are closed in the orthodox manner.

B. The left upper oblique incision is similar to the right (Figure I B). It was at first used only for preliminary abdominal exploration to determine operability of high gastric carcinoma, the intention being to extend it into the thorax as a Humphrey's incision if such proved favourable. It was not long before a case proved to be benign and was found to be readily manageable by a purely abdominal incision. Such subtotal gastrectomy proved so satisfactory (the incision corresponding to the long axis of the stomach) that the writer's elective approach is now as follows:

Gastric ulcer and carcinoma, irrespective of site, are approached through this incision, controlled anaesthesia being used, the patient placed in position as recommended by Humphreys (1946) for a possible abdomino-thoracic approach, and the requisite instruments for such made ready. If practicable, the operation is completed through this abdominal incision, but no hesitation is shown in extending it into the thorax if necessary.

Because of the facility with which abdominal gastrectomy for gastric lesions is performed through this incision with the patient in Humphreys' position, both incision and position are now used as routine for gastrectomy for duodenal ulcer, anaesthesia, however, not being chosen primarily to allow opening of the thorax. The slight elevation of the patient's left side provided by this position is of decided advantage.

Certain features of these incisions require comment.

A. *The exposure obtained.*

Gurd, who has written considerably as an advocate of transverse incisions, as recently as 1947 stated that lateral extension of such incisions is limited by the costal margin. He and many other writers illustrate many types of abdominal incision, but none indicate that an extension over the chest wall might be of advantage.

In the light of the author's experience, the following recent comment of Edwards (1948) makes curious reading. He states: "The limits imposed by the costal cartilages to the length of a supraumbilical transverse incision in patients with a narrow costal angle are so severe that exposure obtained is insufficient even for operations limited to the pyloro-duodenal region."

The essential procedure in the upper oblique incisions here described is the prolongation of the incision for four inches over the chest wall and the splitting and retraction of the subjacent external oblique muscle. The extent of exposure thus obtained has been indicated above.

If appropriate anaesthesia has been used, each may be readily extended into the thorax for a considerable distance. Extension in the other direction across to the opposite side of the abdomen is equally readily carried out by division of the other rectus muscle and other structures along the opposite upper oblique line.

B. *Firmness of closure.*

Although closure takes a little more time than with a vertical incision, the ease and firmness with which the peritoneum, posterior sheath and transversus muscle are opposed, are striking.

Often an intercostal nerve is neither seen nor cut. If one should be seen, as its abdominal course is nearly parallel to the line of the incision, it can usually be avoided and retracted with the associated muscle. In any case, division of one nerve does not result in evidence of rectus paralysis.

Although these incisions have not been in use for a sufficient period to allow analysis of late results, the investigations of Singleton (1947) suggest that post-operative hernia is less likely than with vertical incisions. His

analysis of 9000 consecutive laparotomies revealed .92 per cent. hernias where lateral transverse incisions were used, and 2.24 per cent. where the incision was vertical.

C. *Post-operative comfort.*

Because the movements of the lower chest wall and abdominal muscles associated with breathing, coughing and vomiting exert stress along the line of the incision instead of across it, as in vertical incisions, the discomfort associated with these acts is much lessened.

Consequently, pain is less, normal respiration is more free, coughing is not voluntarily restricted, and it is much easier to encourage the patient to carry out those deliberate breathing and coughing exercises necessary to prevent atelectasis.

SUMMARY.

Two incisions, oblique in direction and apparently not described previously, are suggested for the approach to the upper abdomen for the majority of upper abdominal operations.

Each may be extended at its inner end to allow access to the other side of the abdomen, and at its outer end into the thorax to form the abdomino-thoracic incision of Humphreys.

Compared to vertical incisions, the author considers that the access obtained is superior, closure is more readily performed and appears to be stronger, and post-operative discomfort is much less.

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CASE REPORTS.

RECURRENT MENINGITIC INFECTION THROUGH AN OLD DURAL OPENING FROM A MASTOID WOUND.

By DOUGLAS MILLER.

Sydney.

(Accepted for publication, 17/6/49.)

THE following case of recurrent meningitis following a streptococcal mastoid infection makes a valuable comment on the practice of opening the dura for exploratory purposes during a mastoid operation.

A male child aged 11 was admitted to hospital on 22/2/47. His parents stated that for five days he had suffered severe right-sided ear-ache. He had then become unconscious and had taken several severe epileptic fits affecting only his left side.

On admission he was comatose. He was having frequent epileptic fits affecting the left side of his body.

The following day he was operated on, the right mastoid region being opened. Pus was found. During the operation the dura was exposed and opened and a brain needle was inserted. No pus was obtained from the intradural tissues. His wound was packed.

His c.s.f. was obtained by lumbar puncture. The fluid was turbid and provided a culture of stroptococcus viridans which was also cultured from the wound. On 28/2/47 he had recovered. Three days later his c.s.f. had 30 cells and the culture was sterile. On 17/3/47, routine ventriculography showed normal ventricles.

He was next admitted to hospital on 19/8/48. He had complained for one week of severe right-sided ear-ache, and for four days prior to admission had been stuporose.

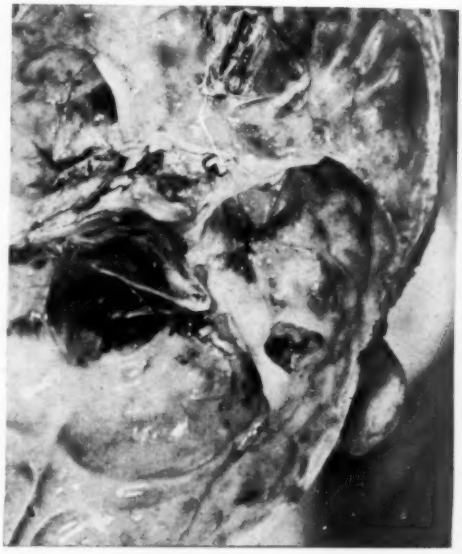
On examination he was unconscious and having frequent epileptic convulsions on the left side of his body.

His c.s.f. obtained by cisternal puncture showed a cell count of 275 cells and protein of 380 mgm. per cent. Ventriculograms were normal.

Two days later he died.

Autopsy.

Greenish pus in the sulci on both sides of the brain, more marked on the right. The dura over the right petrous temporal region presented a hole 3 x 4 mm. in diameter. This led into a cavity in the bone of the mastoid region which was full of pus and necrotic debris. The cavity measured 6 x 8 mm. in diameter and was 1.5 cms. deep. There was no brain abscess.



Base of skull with intact dura, showing large opening into mastoid cavity.

There had been no suggestion of any dural formation over this cavity, which appeared to be directly in communication with the subdural space and certainly not shut off by more than filmy arachnoid adhesions.

SUMMARY.

The case reported is one of otitic meningitis in which following a mastoid operation with opening of the dura, infection remained in the mastoid cavity, and 18 months later caused a fatal meningitis. The operative opening made between the mastoid cavity and the intradural space had never closed.

REPORT OF A CASE OF A RETROVESICAL POLYCYSTIC TUMOUR OF PROBABLE PROSTATIC ORIGIN.

By H. G. CUMMINE and A. S. JOHNSON.

Sydney.

(Accepted for publication, 17/6/49.)

THE patient, a male aged 59 years, was admitted to the Royal Prince Alfred Hospital on 13/2/47. A diagnosis of acute retention of urine had been made. A large uniform cystic mass was present in the suprapubic region extending up as far as the umbilicus. This was thought to be a distended bladder. The patient stated that this swelling had been present for "a few days." Mild scalding on micturition and some difficulty in initiating the act had been present for a year. Urine was passed four times during the day and twice each night. Per rectum the prostate gland was found to be only slightly enlarged. Attempts to pass a urethral catheter failed.

The only previous operation had been the repair of bilateral inguinal herniae in 1941.

Under the impression that the diagnosis was acute retention due to prostatic obstruction, a suprapubic cystostomy was commenced. On opening the bladder, ten ounces of urine were evacuated, and it was then found that the whole bladder was pushed forward and perched on a large retrovesical mass. A metal sound passed easily from the bladder through the urethra. A White's catheter was sewn into the bladder and then the peritoneal cavity was opened. A large cystic mass was palpated lying between the rectum and the bladder, outside the peritoneal cavity and appearing to rise from the region of the rectovesical fascia. An attempt was made to aspirate the mass and a few cubic centimetres of fluid were withdrawn with some difficulty. An incision was then made into the mass and it was found to be multilocular in nature. Some of the locules contained chocolate and others milky fluid. The peritoneal cavity was then closed and an attempt made to free the tumour extraperitoneally. The peritoneum was dissected from the capsule of the tumour fairly readily, but some care had to be exercised in separating the ureters which were displaced laterally and passed around each side of the mass towards its base, but were not adherent to it. Eventually the bulk of the tumour was freed, but the base was hard and fixed at its origin deep in the rectovesical region, rendering complete removal impossible. Accordingly, as much of the tumour as possible was removed after it had been cut across as low down in the pelvis as possible. The stump was over-sewn and the retrovesical space was drained by a large tube around which gauze was packed.

On the seventh post-operative day the abdomen burst open along the suture line and closure was carried out under pentothal anaesthesia. The general condition of the patient deteriorated and death occurred a month after the initial operation. The blood urea three days after operation was 115 mgm. per cent., and this progressively increased until it was 531 mgm. per cent. just before death.

At autopsy some infection of the pedicle stumps was found to be present. The prostate was not abnormal. There was no gross dilation of the ureters or kidneys.

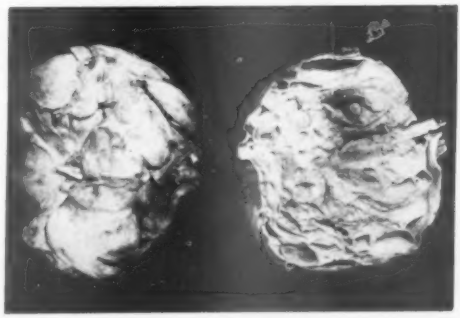


FIGURE I. The cyst is cut across and both surfaces are shown. The many little locules are apparent from the internal aspect and the thick capsule is seen from the external aspect.

The pathological report upon the specimen removed at operation was as follows:

"*Macroscopic:* The specimen consists of a very large tumour which is roughly disc-shaped and measures 20 x 15 x 6 cms. The tumour is made up of a series of thin-walled cysts full of thin fluid which is cloudy in some locules and chocolate-coloured in others. Part of the outer cyst wall is solid and has a brownish grey colour." (See Figure I.)

"*Microscopic:* In the more solid portion there are seen to be a large number of gland-like structures embedded in a fibro-muscular stroma. The glands are lined by epithelium which is mainly columnar, but in many glands there is a layer of small cuboidal cells between these and the basement membrane. The structure of this tissue recalls that of the prostate gland. Other sections include parts of the wall of some of the locules and the epithelium lining there is mainly atrophic and the wall is partly oedematous, but here also some involuntary muscle is present. The mass appears to be the result of a developmental abnormality which is akin to that which forms the prostate." (See Figure II.)

FIGURE II. Showing the microscopic structure of the tumour.

COMMENT.

This case has been reported because of its most unusual nature.

In view of the structure and size of the tumour, the short duration of the symptoms and the patient's ignorance of the presence of the large abdominal mass are rather puzzling phenomena. It is probable that the renal failure was not a post-operative complication, but the maturing of a failure of renal function, the first manifestation of which, oliguria, caused the patient to seek attention. The absence of the pain which ordinarily accompanies retention of urine was a marked feature, the importance of which, however, was overlooked at the time.

ACKNOWLEDGMENTS.

Our thanks are due to Mr. M. S. S. Earlam, under whom the patient was admitted, for kind permission to publish the findings.

Dr. G. F. S. Davies, Pathologist of the Royal Prince Alfred Hospital, reported upon the specimen removed at operation and performed the autopsy, and his help is gratefully acknowledged.

STATISTICAL REVIEW.

CANCER OF THE OVARY.

Review of Results on 100 Cases.

By J. G. O'Donoghue.

Melbourne.

(Accepted for publication, 22/11/48.)

THE material for this review was obtained from the records of 100 proved cases of ovarian cancer treated at St. Vincent's Hospital, Melbourne, over the period 1927-1947.

TABLE I.

Age Incidence:

Age Group.	Number of cases.
0–20	1
21–30	1
31–40	11
41–50	28
51–60	30
over 60	29
	100

TABLE II.

Types of Tumour:

Papillary cyst-adenocarcinoma	68
Pseudo-mucinous cyst-adenocarcinoma	11
Cystic teratoma	2
Fibro-sarcoma	1
Sarcoma	1
Mesonephroma	1
Krukenberg tumour	2
Unclassified	14
	100

Notes:

52 tumours were bilateral.
32 tumours were unilateral.
in 14 cases, information not definite.
Histological grading proved to be no help in regard to prognosis.

It was observed that most cystic carcinomata of the ovary apparently result from malignant change in pre-existing cystadenomata. Novak (1947) states that the incidence of malignant change in the serous cystadenomata is much greater than in the pseudo-mucinous variety. Some tumours of cystadenomatous architecture appeared to be malignant from the beginning. Every grade of malignancy appeared to exist.

TABLE III.

Menstrual History:

44 were menstruating normally.
56 had passed through a normal menopause.
37 had had at some time a disturbance of the cycle in the form of menorrhagia or metrorrhagia.

TABLE IV.

Marriage and Pregnancy:

24 were single.
76 were married, of whom 31 had never been pregnant.
48 had borne children.

TABLE V.

Main signs and symptoms:

Abdominal pain	14
„ enlargement	64
Loss of weight	16
Vomiting	2
Ascites	2
Haemorrhage	2
	100

Note:

The abdominal pain was usually vague and intermittent at first, but rapidly became more severe and constant.
40 had ascites, 56 did not, no report on 4.
65 were hopelessly involved when admitted to hospital.
18 had symptoms of less than 1 month.
32 had symptoms for less than 2 months.
17 had a palpable tumour.
15 were detected during routine pelvic examination.

TABLE VI.

Treatment:

75 patients treated prior to 1943 (5-year follow-up).

	Number.	Survived 5 years or more.
Unilateral oophorectomy	9	2
Bilateral oophorectomy	7	2
Supra-vaginal hysterectomy and bilateral oophorectomy	5	2
Total hysterectomy and bilateral oophorectomy	2	1
Exploratory Laparotomy only	35	0
Considered inoperable	10	0
No record available	7	—
	75	7

TABLE VII.

Results of Treatment:

A. 75 patients treated prior to 1943.

No recurrence (5 years and over) ..	7
Dead or known recurrency	51
No follow-up	7
Inoperable—dead	10
	75

B. 25 patients treated since 1943.

No recurrence 1 year	2	3
" " 2 years	1	
" " 3 years	1	4
" " 4 years	3	
Dead or known recurrency	12	
No follow-up	1	
Inoperable	5	
	25	

Histological grading:

In an attempt to correlate prognosis with histological appearances, three grades were recognised:

Grade I:

Good glandular formation, well differentiated epithelium. Mature type of structure maintained. Least malignant.

Grade II:

Glandular and papillary structures still present, but poorly developed. Epithelium not well differentiated. Moderately malignant.

Grade III:

Little evidence of glandular and papillary structure. Most malignant.

It was not found possible to correlate the grade of malignancy with prognosis. For example, one patient who survived for 12 years had a Grade II malignancy, whereas another patient with a Grade I malignancy survived for only five months.

Clinical grouping:

The following groups were differentiated:

Group I:

Tumour completely removable.

Group II:

Tumour completely removable, but involving other structures.

Group III:

Tumour only partly removable because of extension to nearby structures which are not removable.

Group IV:

Tumour irremovable because of extensive involvement of adjacent parts or because of metastases.

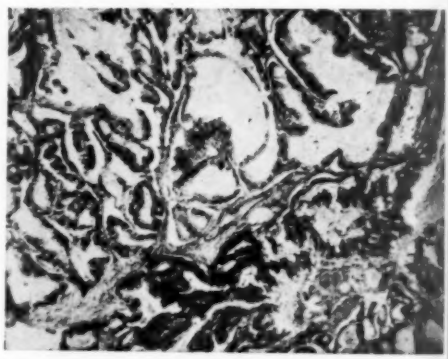
TABLE VIII.

Survival according to Clinical Groups:

Clinical Group.	No. of cases.	Number traced.	Average survival time.
I ..	11	9	38 months
II ..	22	20	36 "
III ..	48	45	19 "
IV ..	19	18	5 "

Lynch (1936) reported a salvage rate of 35% (excluding granulosa-cell tumours).

Pemberton (1940) reported a five-year salvage of 32% (also excluding granulosa-cell tumours).



Grade I: malignancy. Good glandular formation, well differentiated epithelium. Mature type of structure maintained. Least malignant type. Adenocarcinoma of ovary, pseudomucinous in type.

Taylor and Greely (1933) salvaged on 15.2%. The five-year salvage rate on the present series was 11% (see Table VII).

Radiation Therapy:

Unfortunately, in this hospital, deep X-ray therapy has not been in use for a sufficiently long period to allow conclusions to be drawn as to its value.

COMMENTARY.

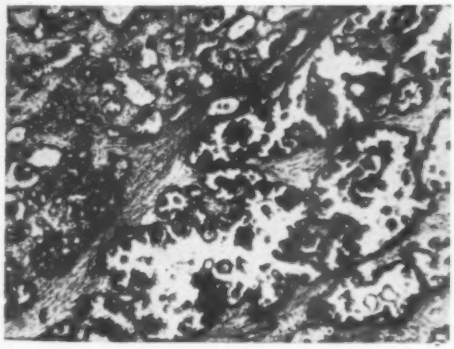
The menstrual history, marital state or occurrence of pregnancy does not in this series provide any significant data.

There is no characteristic symptom or sign. Induration, fixation and the presence of bilateral tumours suggest malignancy.

It would seem that the only possible way of diagnosing these neoplasms in an early stage would be the routine examination of all women over 35 at six-monthly intervals. The vast majority of women will not co-operate in such a programme.

High-power view of Slide 1.

The treatment of benign papillary cystadenoma is excision. This is so often the forerunner of carcinoma that even during the child-bearing period, if the tumours are bilateral, careful consideration must be given to the bilateral removal of the pre-malignant growths.

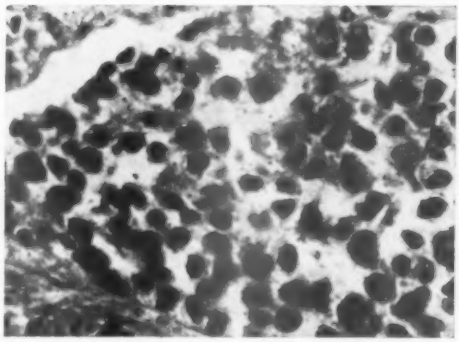


Papillary cystadenocarcinoma of the ovary. Glandular and papillary structures still present but poorly developed. Epithelium not well differentiated. Grade II. Moderately malignant.

Perhaps more radical surgery, including the total removal of the uterus and adnexae if done early enough, will improve the survival rates.

CONCLUSIONS.

1. With an incidence of 15% of all ovarian neoplasms (Bernstein, 1936) and a mortality rate which is still appallingly high, ovarian cancer constitutes a major gynaecological problem.
2. Most cystic carcinomata result from malignant change in pre-existing cystadenomata.
3. All cystadenomata should be regarded as potentially malignant. Although these tumours appear to be benign, they should be opened in the operating theatre by an assistant and carefully inspected for gross malignant changes.
4. Histological appearances do not constitute a guide to prognosis.



Necrotic highly cellular malignant tumour of the ovary. Little evidence of glandular and papillary structure. Grade III. Most malignant type.

5. Routine pelvic examination may reveal the presence of these neoplasms. All solid ovarian tumours should be regarded as potentially malignant.
6. The question of more radical procedures needs consideration.
7. Possibly intensive deep radiation therapy may help in the cure of these patients.

ACKNOWLEDGMENTS.

I am indebted to Dr. A. Brenan, Pathology Department, St. Vincent's Hospital, for the pathological reports and sections, and to Dr. H. Bettinger, of the Women's Hospital, for the preparation of the microphotographs used in this paper.

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